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OUR CONVENTION REPORT.

We print elsewhere in this issue an abstracted report of the doings of last week's convention, giving in more or less detail the principal parts of the papers read and the discussions pertaining to each, at the same time reserving for other columns, in both this and the next issue, a lengthy abstract of the more important papers and discussions. This plan will, we trust, meet with the approval of our readers, inasmuch as it affords a general index to the character of the proceedings, and at the same time presents to those who may so desire an opportunity to study the more important papers in detail.

INSTITUTE PAPERS.

We have recently called attention to the desirability of having papers which are to be presented before the Institute printed and distributed to the members some time in advance of the meeting, so as to obviate the necessity of having the entire paper read, and thus allow of sufficient time for discussion. The members of the National Electric Light Association have had firmly impressed upon them during the past week the wisdom of such action, and as a consequence adopted a resolution to the effect that all papers must be submitted to the Executive Committee for its approval, and if approved, such papers are to be printed and distributed to the members one week in advance of the convention, at which time they are to be read only by special request. It is, of course, obvious that the requirements of a resolution of this kind can be more sedulously fulfilled in an association holding annual meetings than in a body such as the Institute, in which the meetings are monthly, but it, however, remains possible to materially improve the condition as it now exists, and we trust that steps will be taken at the coming annual meeting to more effectually carry out in this respect the purposes of the organization.

"THE ELECTRICAL WORLD" AT THE LAST FIVE CONVENTIONS

The number of THE ELECTRICAL WORLD distributed and read at the Nineteenth Convention of the National Electric Light Association in New York last week was the largest electrical periodical that was ever sent to an electric light convention, and contained the largest number of advertisements, as well as the largest volume of advertising. The figures for the corresponding issues of the WORLD for the last five years, so far as the advertising is concerned (omitting all publishers' or office advertising), are here given for comparison:

	VOLUME OF ADVERTISING.		
YEAR.	PAGES.	NUMBER.	INCHES.
1892	52	357	2613
1893	56	378	2828
1894	76	378	3227
1895	84	391	3573
1896	88	415	3679

THE STATUS OF A CENTRAL-STATION COMPANY.

We are obliged to take issue with Judge Armstrong when he says that "the question of deciding whether an electric light and power company is a manufacturing company or not does not depend on any legislative or judicial determination, but is a question of fact absolutely, and the people to decide the question are those who are expert in this particular business." Indeed, we are quite firmly convinced in our own minds, and there would seem no apparent reason why experts "in this particular business" should not be of the same opinion, that such companies are manufacturing concerns, and further, it is not the mere application of a term, but a consideration of a "fact" which forms the basis of our decision. Even facts, however, have proved at times the most stubborn, and so after we have thus decided, even though the asso-

ciation had so decided, the question still remains for judicial or legislative action, like any other question of either fact or fancy that may arise between individuals or corporations and the state. Inasmuch as the courts of Pennsylvania have affirmed that central-station companies are not manufacturing companies, it shows that the question of fact, as we look upon it, has not been demonstrated. It is somewhat surprising that Judge Armstrong should have taken such a peculiar view of this question.

THE ELECTRICAL EXPOSITION.

Amid the blare of trumpets, the booming of cannon, and other spectacular accompaniments the Electrical Exposition was opened last Monday night, when Gov. Morton touched the golden key and electricity or something else did the rest. The more dignified features of the ceremony were conducted with proper decorum, and it is safe to say that no exhibition of this character was ever opened with greater enthusiasm and under more favorable auspices. The exhibition is notable for its varied character, and probably every application of electricity is represented, excepting the heavier electric railway apparatus, which is conspicuously absent. The absence of those devices which are outlawed by the legitimate trade, and commonly known as "fakes," is also notable. Whether this is due to the wisdom of the managers or to a lack of courage on the part of these insinuating quacks we do not know, yet we incline to give the managers of the exhibition the credit of intentionally excluding these illegitimate enterprises because those who usually engage in them never lack in audacity and nothing is allowed to thwart their plans if they can help themselves. In regard to the Exposition much of a commendatory character can be said. It is complete and satisfactory in every way, and although it is a purely business enterprise, it is serving an excellent purpose in educating the people as to the part electricity plays in their every-day affairs. Judging from the crowds that have thus far attended, the managers could not have selected a better time and place for it. To those interested in electricity it offers an opportunity that very rarely presents itself, to study the progress made in its development from the earliest days of the science down to the present time. There may be seen in close juxtaposition the embryotic forms of the various apparatus and devices and the highly developed machines of to-day. The contrast is indeed striking, and it emphasizes most positively the wonderful development made along the various lines. Various designs of direct and alternating-current generators and motors are shown, and the variety of arc lamps bears evidence of the vast amount of effort being put forth to improve upon the design and construction of this apparatus. Of other devices—but no less important—there is no end, and any one interested can occupy his time for several days in studying the many things presented for favorable consideration. Independent telephone interests deserve a word of commendation for their enterprise and efforts to demonstrate to the public that there is more than one good telephone in the world. The number of different makes of telephones is one of the features of this Exposition. The storage battery occupies a prominent place also, and takes rank as a leading commercial product. The effect of this exhibition on the electrical business in general, it seems to us, will be of most wholesome character, and we trust that those who have engaged in the venture as exhibitors will realize all the benefits they hope to attain.

THE CONVENTION PAPERS.

Although the papers presented before the convention last week do not as a whole show the originality of those read before the Cleveland convention, they treat of subjects which are of the first importance to the members of the association, and contain many points which warrant the most careful study on the part of those whose business it is to supervise the equipment and operation of central stations and systems of distribution. There is one subject, however, which the central-station manager may for the present, at least, safely dismiss from his mind, and that is the commercial application of acetylene gas as produced from calcium carbide. The objectionable qualities which this gas possesses, together with its comparatively high cost of production, are, when combined, sufficient to offset the recognized good qualities which might lead to its general use. The paper presented by Mr. Ferguson, although explicit and logical in its treatment, does not satisfactorily clear up the question of the actual cost of producing calcium carbide on a large scale, inasmuch as it is based, like most other estimates hitherto presented, on data representing tests of but a few hours' duration and therefore too meagre in scope to form the basis of a general conclusion. Mr. Ferguson has made good use of the data at his disposal and finds that the cost of producing one ton of calcium carbide at Niagara with electrical energy at $20 per hp-year would be about $34, a figure in quite close agreement with other conservative estimates. Allowing $3 per ton for shipping, he finds that, candle for candle, acetylene gas in New York City could not be produced at a figure less than 20 per cent. above that of ordinary illuminating gas, a figure which, excepting in certain specific cases, is in all probability prohibitive. If we may be permitted to judge from the paper read by Mr. Emmet and some of the remarks which followed in the discussion, it would seem that American practice is just awakening to the use of large transformers and secondary mains in general distribution, long since recognized on the Continent as not only the most economical, but affording the easiest means of regulation. Mr. Dow stated, however, that he had adopted the policy of using large transformers as early as 1889, and has ever since favored their use, even when it became a question of nearly equal first cost of transformers and secondary mains. The half-hearted development of alternating-current apparatus which Mr. Emmet mentions is to be attributed, doubtless, as much to the employment of small, inefficient transformers, as to the combination of several other less important factors. The reluctance with which the change has taken place from past practice to that "on thoroughly modern and improved lines," as designated by the author, is not only remarkable, but difficult to account for on the ground of conservatism. The paper which met with the most hearty approval by the members, that read by Mr. Rogers, introduces to more critical notice the imperfections of existing arc lamps, and will assuredly have the tendency of producing radical changes in this important piece of apparatus.

LARGEST CONVENTION REPORT NUMBER EVER PUBLISHED.

This week's issue of The Electrical World consists of no fewer than 44 pages of reading matter and a round 100 pages of advertisements. In no previous Convention Report issue of even the World has either the number of reading or the number of advertising pages reached such high figures. Neither it nor any other electrical publication has ever before printed 100 pages of advertisements in a single issue. The following comparison between this and other annual Convention Report numbers since the change in size of The Electrical World cannot fail to be interesting:

	PAGES OF	VOLUME OF ADVERTISING		
YEAR.	READING MATTER.	PAGES.	NUMBER.	INCHES.
1894	40	76	379	3192
1895	40	88	403	3589
1896	44	100	446	4268

This table demonstrates that notwithstanding the commercial depression which has interfered so seriously with many other lines of business, the electrical industries are not only still active and still progressive, but continue to reach out for new realms to conquer. In these figures advertisements of the publisher are omitted.

Source of Röntgen Rays.

An article on the source of Röntgen rays, by Messrs. Michelson and Stratton, appears in *Science*, May 8, which, although confirmatory of the results hitherto accepted, still demonstrates in another way that in the form of tube used by the authors the rays radiate in all directions from the surface first encountered by the cathode rays, and that they do not, as stated by them, start from the anode. They employed a German glass tube, one end of which was drawn out, and an aluminum electrode terminating in a disc inserted at this end. A second was inserted in the side and enclosed in a thick piece of glass tubing to prevent any radiations from it reaching either the first electrode or an aluminum window at the other end of the tube. This window was three millimetres thick, except at the centre, where it was ground away to a thickness of about one tenth of a millimetre. The joint was made by melting shellac, containing a small quantity of rubber, around the outside.

A photographic plate in its plate-holder was first placed opposite the window, the electrode at the other end of the tube being made the cathode and the window the anode. The result shows that the Röntgen rays radiate in all directions from the thin portion of the window.

In the second experiment, the window was made the cathode and the opposite electrode the anode. The resulting picture shows that the Röntgen rays radiate from the end electrode and cast a shadow of the window. In the third experiment the window was again made the cathode and the side electrode the anode. This picture also shows that the rays radiate from the end electrode.

The authors say that while it is possible to explain experiments one and two by considering that the Röntgen rays radiate from the anode, no such explanation will account for the third experiment, in which the undoubted source at the end electrode was unconnected with either terminal of the secondary coil which furnished the discharge.

On the other hand, not only are all three experiments consistent with the statement given above, but the origin of the Röntgen rays at the place where fluorescence is excited on the glass walls of the common form of Crookes' tube is also thereby accounted for. They conclude by saying that although it may be true that the effects may be enhanced by making the anode the first object encountered by the cathode discharge, the results of their experiments are to show that the anode does not play an important role in the phenomenon, a conclusion hitherto quite generally accepted.

A Visit to the Crocker-Wheeler Works.

More than 500 people, including many ladies, accepted the invitation of the Crocker-Wheeler Electric Company and visited their factory at Ampere, N. J., on Thursday evening last. A special train was provided for the guests, and upon arriving at the works they were confronted by a dazzling display of electric lights, almost noiselessly moving machinery and the melodious strains of an orchestra. Work in the new and splendidly equipped shop was in full operation, and two hours were profitably spent in inspecting the operation of machine tools directly driven by individual motors.

Convention Numbers for Four Years Compared.

This table shows the volume of advertising in inches in THE ELECTRICAL WORLD'S two electric light convention issues of each year for the last four years—the number read at the convention and the number containing the report of the proceedings, respectively:

1893.	1894.	1895.	1896.
6127 inches.	6419 inches.	7162 inches.	7947 inches.

Increase 1894 over 1893, 5 %. 1895 over 1894, 12 %. 1896 over 1895, 11 %.

A CURIOUS RÖNTGEN RAY EFFECT. (SEE PAGE 572.)

The Source of Röntgen Rays.

BY ALEXANDER MACFARLANE.

With the co-operation of Messrs. Klinck and Webb I have made some further experiments on the source of the Röntgen rays, using the method described in our former communication.* The tube examined is smaller, of lower exhaustion, and of a different type from that previously employed. It consists of a cylindrical tube of German glass, five inches long and seven eighths of an inch in diameter, and has fixed on near one end a semi-spherical bulb of uranium glass, the diameter of which is one and one-half inches. The electrodes are of aluminum; one has the form of a disc four tenths of an inch in diameter, and one sixteenth of an inch in thickness; the other has the form of a cylinder one-half inch long and one eighth of an inch in diameter. The disc, which is intended for the cathode, is suspended at the centre of the semi-sphere by a glass-covered

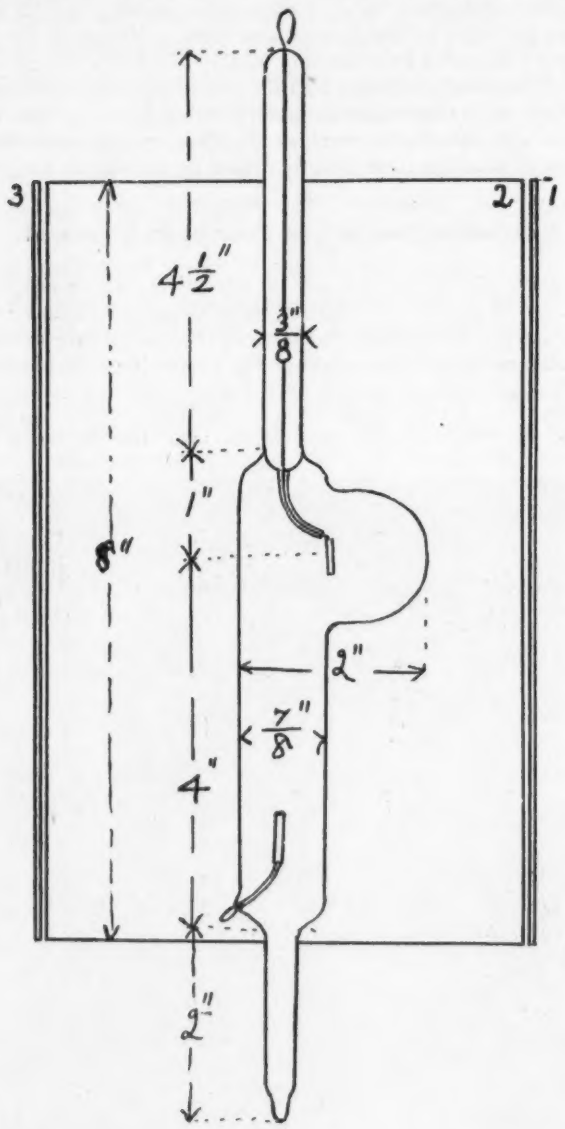


FIG. 1.

wire passing through the end of the tube, and through an auxiliary tube attached to the end; the cylinder is supported longitudinally near the other end. The distance from the centre of the disc to the centre of the cylinder is three and one eighth inches.

In our first trial the disc was made the cathode, and photographic plates 1. 2 and 3, covered by nail-boards, were placed as shown in Fig. 1, plate 1, in front of the semi-spherical bulb, plate 2 at the side and plate 3 at the back. As a result we found in the case of Plate 1 that each nail cast three distinct shadows, diverging from very nearly the same point and all symmetrical with respect to the position of the disc in the centre. Plate 2 indicated very clearly the existence of three systems of radiation, the shadows all pointing to the disc in the centre, but one set is symmetrical with respect to the axis of the tube; the other two are equally inclined to it. Plate 2 at the back gave two distinct systems of shadows, symmetrical with respect to the disc and converging to nearly the same point. On

*THE ELECTRICAL WORLD, March 14, 1896.

each of these three plates there was an especially bright band 1½ inches in width, transverse to the tube, and having the disc in its centre. While the tube was in operation there was only a faint

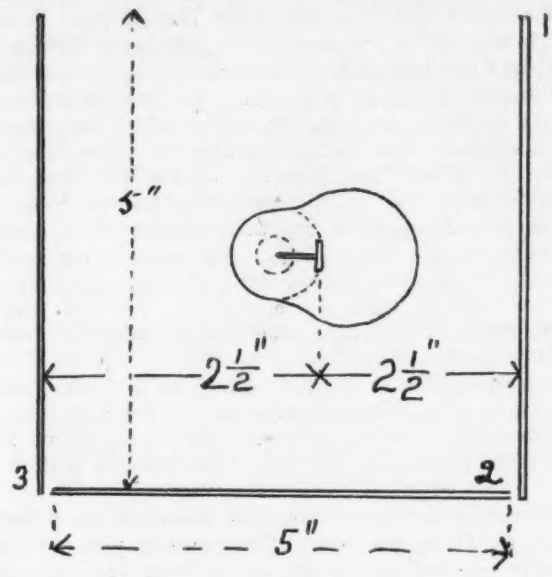


FIG. 2.

fluorescence on the bulb, but on the walls of the tube on opposite sides of the disc there were dark patches of an irregular star outline, surrounded by yellow light, particularly on the side next to the cylinder.

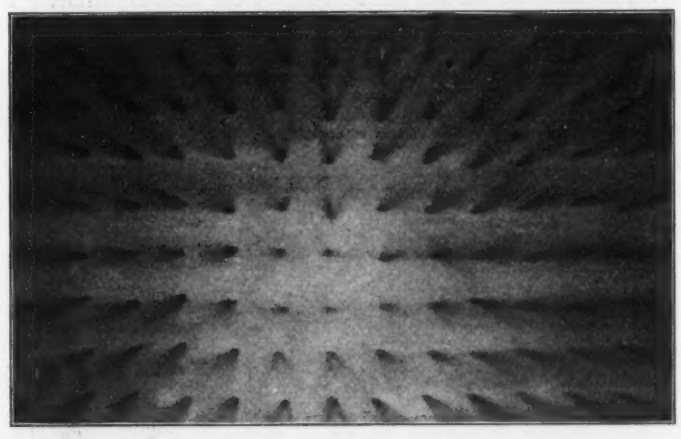


FIG. 3.

Flickers occurred at the rate of about 20 per minute, but they were of very short duration. These were evidently due to a momentary reversal of the electrodes. The black patch is where the cathode rays strike when there is a comparatively low exhaustion.

In the second experiment the cylinder was made the cathode and

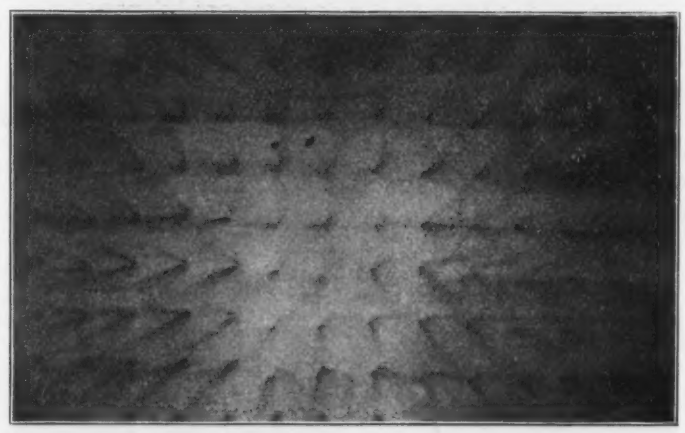


FIG. 4.

the disc the anode, and three plates, 4, 5, 6 and Fig. 2, were exposed in front, to the side and behind the bulb as formerly. Plate 4 gave a duplex system of shadows, one of which, the more intense, pointed

to the cylinder, while the other pointed to the disc. The distance between these centres of radiation on the photographic plate was three inches, the same as the distance between the electrodes. The system of shadows pointing to the cylinder gave slight evidence of doubleness. Plates 5 and 6 indicated the same as 4, only the shadows due to the cylinder are in some places clearly double. During the operation there was a dark patch on the tube near the cylinder and on the side toward the disc; a section of the tube starting from the inner end of the patch and cutting obliquely in the direction of the disc separated the yellow fluorescence from the dark or neutral part round the cylinder. The flickering was not so marked as in the other case.

How is the triplex character of the radiation in the first case to be explained? None of them can be explained by reversal, for they are all symmetrical with the disc. All the indications point to the surface of the bulb, the aluminum disc in the centre, and the back wall of the tube as the active surfaces. If so, it follows that the aluminum disc, when a cathode, can act as a source of Röntgen rays, or else that

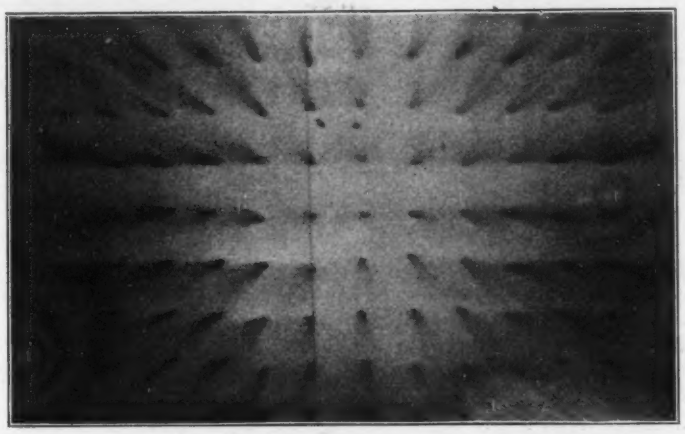


FIG. 5.

it is excited by reflection of its own cathode rays from the back wall of the tube. In the light of the experiments of Cory, Le Conte, Lohman* and of Lodge† the latter appears the more likely explanation.

In the second case, how is the radiation from the anode to be accounted for? Prof. Hering ‡ explains anodic rays by a reversal of the electrodes for a short time. In this case the reversal was very much less than in the previous, when there was no anodic radiation. Hence I conclude that it was either due to the fact that the anode may be an independent source, as Rowland has maintained, or else that it was due to the disc being bombarded by rays emanating from the cathode. A consideration of the actual circumstances of the case does not favor the latter explanation, for the cathode rays could only

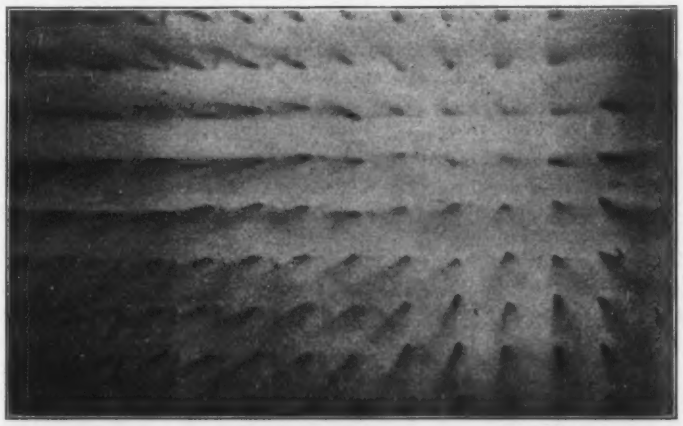


FIG. 6.

reach the disc after repeated reflection at the walls of the tube, and at best the disc would expose only a small cross-section to their path.

Finally, it is evident from these radiographs that visible fluorescence of the glass is not a necessary accompaniment of the production of the Röntgen rays.

Cathode rays appear to be due to radiant matter, as Crookes maintained, while Röntgen rays appear to be light waves too short to lie within the range of vision.

* THE ELECTRICAL WORLD, April 18, p. 424.
† *Ibid.*, May 2, p. 483. ‡ *Ibid.*, March 7, p. 255.

Notes on General Electric Alternating-Current Machinery—VI.

TWO distinct types of potential regulators are now being built by the General Electric Company, one of unitooth construction, and designated as M. R., and the second of multi-tooth construction, and designated as I. R. The M. R. regulators consist of two stationary coils placed at right angles to each other and fitted into four large slots in an exterior stationary magnetic iron circuit. Within the coils is an iron core which is capable of being turned in relation to the stationary field, so that by moving this core 90 degrees the flux set up by one of the coils, which is the primary, may be shifted in its direction so that more or less lines of induction interlink with the secondary coil, and thus produce an increase or decrease of the secondary potential. The primary coil is

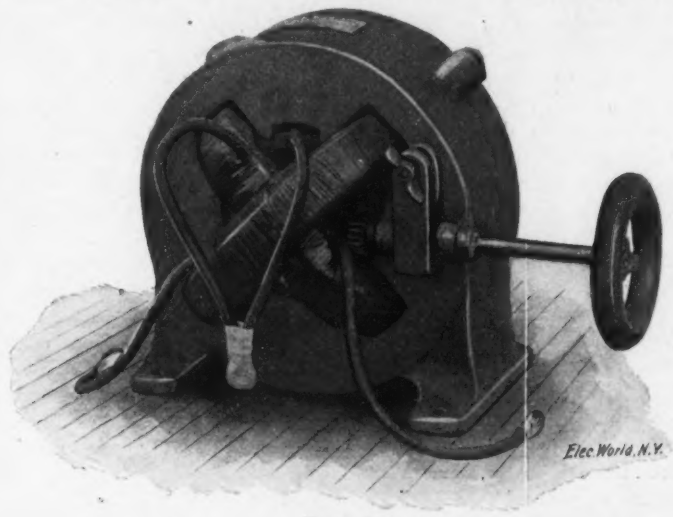
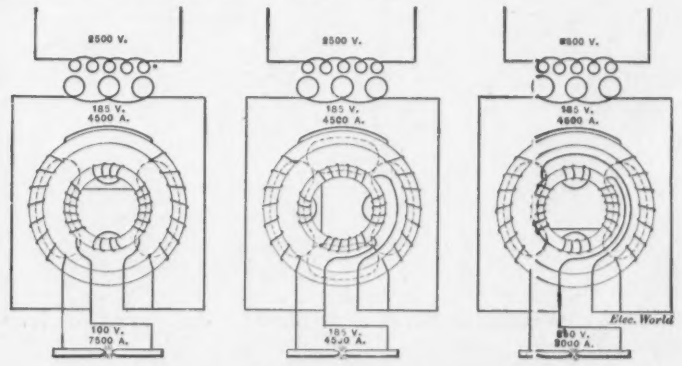


FIG. 48.

in parallel with the mains, while the secondary is in series, and therefore the difference of potential on the mains may be raised or lowered.

These M. R. regulators, as shown in Fig. 48, are built in the following standard styles: The one kw-60-cycle, wound for either 1000 or 2000 volts primary, and permitting of 2½ per cent. or 5 per cent. boosting. The secondary current capacity is from 20 to 40 amperes on those adapted to 1000 volts and from 10 to 20 amperes for those built for 2000 volts. The second size is of 1¼-kw capacity, 125 cycles and wound for the same voltages as the previous. The third size is a 3-kw 60-cycle regulator, wound for either 1000 or 2000 volts and either 2½ or 5 per cent. boosting; that is, with a capacity of 30 to 60 amperes secondary for the regulator having a 2000-volt primary, and from 60 to 120 amperes for the coil having 1000 volts primary. The fourth size is of 3.75-kw capacity, for 125 cycles, and has the same winding as the preceding.



FIGS. 49, 50 AND 51.

A fifth type is designed for 6-kw 60 cycles and wound for the same voltages and percentages of boosting and is built suitable for a 2000-volt circuit with 60 or 120 amperes, or 1000-volt circuit with 120 and 240 amperes respectively.

The sixth type is of 7.5-kw capacity designed for 125 cycles, the same voltages and percentage of boosting, 75 or 150 amperes in the 2000-volt circuit and 150 to 300 amperes in the 1000-volt circuit.

In special cases regulators are built of ratios different from those

given above, as for instance, a great number of 1-kw regulators which are now being built in which the primary is designed for 100 volts and 8 volts boosting.

The I. R. regulators are built upon practically the same lines as the induction motor; that is to say, the movable and stationary members have distributive windings. These I. R. regulators are built in larger sizes, where the unitooth construction of the M. R. regulators would offer too high self-induction, while for smaller sizes the M. R. type is to be preferred.

The principle of these I. R. regulators is that the mutual induction between the primary and secondary is varied by moving the armature of the regulator in relation to the field so that in a particular position the secondary potential is practically added to the primary, while if the armature is moved through the distance between the two poles it is subtracted therefrom, and consequently the terminal voltage, which is the resultant of the effect of the primary on the secondary, is changed.

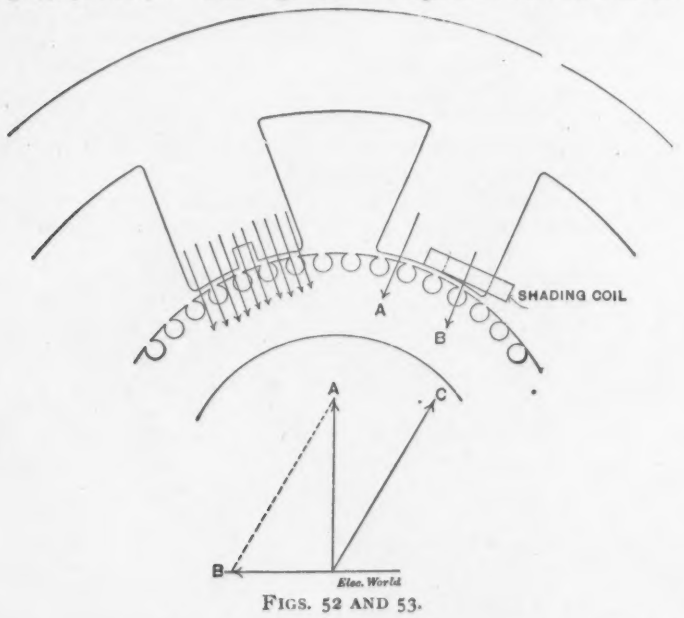
A large-size regulator used in the Carborundum plant at Niagara is described in the Transactions of the American Institute of Electrical Engineers, September, 1895, from which we have taken a few extracts.

This regulator, diagrammatically shown in Figs. 49, 50 and 51, is used on the Niagara power circuit in connection with a stationary transformer, by means of which latter the voltage generated at the power house is reduced from 2200 to 185 volts, and supplied to regulator at this voltage.

By varying the position of the armature, in relation to the field of the regulator, the difference of potential at the secondary, that is, at the Carborundum furnace, can be varied accordingly.

When the furnace is started, that is, when the resistance of the furnace is very high, the position of the armature in relation to the field is such that the secondary voltage is 250 and the secondary current 3000 amperes. As the furnace heats up, the resistance decreases, and consequently the voltage has to be reduced. If the armature is in the middle position between the two extremes, the voltage is 185 and the current is 4500 amperes. In this position, therefore, the regulator neither boosts nor lowers the voltage. When the furnace is going full blast the voltage is still more decreased and the current increased to give the same output, so that we then have 100 volts and 7500 amperes.

The position of the armature and the field are shown plainly in Fig. 49, 50 and 51. This regulator is designed so that the armature



Figs. 52 and 53.

can be moved either by hand or by motor. At present the hand regulation is being used.

Alternating-Current Fan Motor.—Although a number of fan motors have been placed upon the market of practically the same design as that made by the General Electric Company, yet perhaps few have taken the trouble to inform themselves of the principles employed in its action. The motor has a laminated field in one type of eight poles, and is designed for 125 cycles; while in the second type it is designed for 60 cycles and has four poles. Both types run at about 1800 revolutions per minute. The armature is of the squirrel cage pattern; that is, there is no wire wound upon the armature, but it is simply a solid mass of iron and copper.

Partly covering each field spool is a shading coil which consists of a copper ring passing through the middle of the pole, and covering half of it.

The object of these shading coils is to displace the magnetism between the armature and the field, so that the pull, instead of being in the line connecting the centre of the armature with the centre of the field, in which direction, of course, there would be no turning moment, is displaced sideways, thereby causing a continuous pull in a definite direction between the surface of the armature and the field.

If we consider a certain instant, when the current through the field spools is a maximum, and consequently the magnetism going through the pole is a maximum, part of this magnetism, as seen in

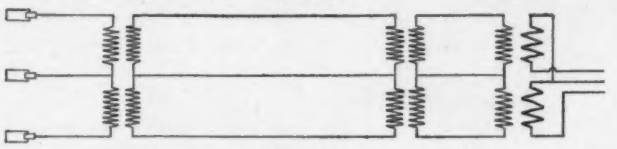


Fig. 54.

the sketch, passes through the short-circuited shading coil, and consequently causes a current to flow in this coil.

Let OA, Fig. 53, be the resultant magnetism of the field excitation and the current in the shading coil, OB is then the secondary current, which is 90 degrees ahead of the magnetism; consequently OC represents the phase relation of the primary current and the magnetism.

Since OC represents the magnetism corresponding to the primary current, and consequently is in the direction of the middle of the pole and the centre of the armature, OA, which is the resultant magnetism, is displaced therefrom, and produces consequently a turning moment on the armature.

Insulators.—With the installation of high-potential plants it has been necessary to improve upon the insulators employed upon the lines carrying high voltages, and after a great deal of experimenting the General Electric Company has now adopted a double-petticoat porcelain insulator for voltages up to 15,000 or 20,000. Before these insulators leave the factory they are subjected to a very careful test at 30,000 volts. It is found that not 1 per cent. of the insulators crack at this potential, but practically all of them stand at least 40,000, even when supported on wet wooden pins and covered with snow or moisture. Since it might be of interest to know how these tests are carried out, we will briefly mention the methods employed.

A ring-shaped transformer made of regular armature punchings is surrounded by a number of wooden spools wound with the primary and secondary coils. By coupling in series or parallel all the primary coils, and likewise all the secondary coils, practically any desired ratio of transformation can be given to the transformers, and in this way any desired voltage or current may be obtained.

The transformers used in testing these insulators are so proportioned as to cause about one ampere to flow in the high potential circuit. To do this the transformer has to have a great deal of self-induction, therefore if there is any possibility of resonance it will be likely to show itself.

If what has been previously stated in this article is recalled, it will be remembered that the conditions for resonance depend upon the product of the capacity and the self-induction; therefore, although the capacity is very small in this circuit, since the self-induction is large, resonance may occur. It is quite necessary, therefore, to shunt the transformers by means of spark gaps, so that when resonance occurs, due to a change in the shape of the wave, the sparks will jump across the needle points in the shunted gap and thus save the transformer.

It has been found that under certain conditions with the same generator and with different kinds of external loads the ratio of transformation, or rather the potential, judging from the ratio of transformation of the transformer, has varied 100 per cent.

These high-potential insulators have been used in several places, for instance, Folsom, Cal.; Guadalahara, Mex.; Regla, Mex., and the circuits upon which they are employed are from 10,000 to 12,000 volts.

There is at present in operation at the Schenectady works a high-potential experimental line transmitting power from the power-house to the punching shop at the potential of 21,000 volts. The difference of potential in the power-house at the terminals of a monocyclic generator is 1000 volts. In a special transformer-house this potential is raised by means of two 30-kw, oil

insulated transformers to practically 20,000 volts. The ratio of transformation of each transformer is 575 to 11,500. By the connections given in Fig. 54 approximately 21,000 volts will be obtained at the terminals. The power is supplied at this potential, and by means of step-down transformers, identical in construction to the step-up transformers, reduced to 1000 volts and further to 110 volts inside the punching shop, where the power is utilized for driving all the punching presses for arc lighting and incandescent lighting. This line has been in continuous and successful operation for about three months.

Electrical Expositions.

It is generally conceded that international exhibitions are indices of the world's progress in the industries, fine arts and sciences there represented, and judging electrical industries by this criterion, there is a most remarkable and interesting record. The year 1881 was the first in which the industry had reached sufficient importance to warrant a purely electrical exhibition. Only three years before, New York electricians had inspected with a great deal of interest and admiration the Brush plant at the fair of the American Institute, held in the old skating rink at Third Avenue and Sixty-first Street. One of these Brush dynamos supplied nine arc-lights in series, in a manner which seemed to indicate commercial success. Of course nine or more lights had been run in series before, but there were very few, even of those who were called electricians, who had seen it done, and most of us were much more familiar with the old Serrin lamps used in stereopticons, which were difficult to keep maintained singly, not to mention anything like a series arrangement.

Paris has ever been a leader in international exhibitions, and in 1881 gave the world the first purely electrical one. By this time American cities had become familiar with not only nine, but forty arc-lights in series supplied from a single dynamo, and more than forty where two or more dynamos were run in series. Still, these were bold advances of the time, which now seem to us as small as the nine arc-light first seen at the skating rink.

In the *Operator* of Oct. 15, 1881, the predecessor of THE ELECTRICAL WORLD, there is a Paris letter describing the progress of the Exposition. In this letter we find these words: "The great Edison machine which is said to run 1200 incandescent lights has just arrived, and the bed-plate is already in the building. It is expected to be in running order in a week or 10 days, and much interest is shown in the result of the experiment." Observe the cautious statement "which is said to run;" this looks stranger at the present time than it did then, but for an exactly opposite reason.

At the Paris Exposition the first electrical congress was held, and it was there that the name ampere was officially adopted for the unit of current. Before that the weber was the unit employed, but from this time the name became an outcast, and found no resting place until after the third electrical congress, which was held in Chicago, in 1893, for there it was proposed as a name for the unit of magnet flux, and officially rejected, but since then, without official sanction, it has been adopted.

Since the Paris Exposition of 1881 there have been many electrical exhibitions, and many of a more general nature, but in all of the latter electricity has been one of the most important features. In 1882 there was held in London, at the Crystal Palace, an electrical exposition, at which many of the exhibits which appeared in Paris the year before were shown, together with some important additions. In the year 1882 there was also held another electrical exposition in Munich, and the next year one at the Aquarium in London and one in Vienna, besides a combination gas and electric light exposition at the Crystal Palace, London. In 1884 there was an electrical exposition in Philadelphia, under the auspices of the Franklin Institute, and second only to that held in Paris in 1881.

The extraordinary interest in electrical matters which is so manifest at the present time may be said to have begun about the year 1876. In this year we had the Centennial Exposition at Philadelphia, where Bell's telephone was first shown to the public. Among those who saw and used it were some of the most eminent scientists of Europe. The exhibition buildings were lighted for the first time by electricity, the Wallace-Farmer dynamo and Wallace plate carbon lamps being used. Only two years before, the invention of Gramme had revolutionized the manufacture of dynamo machinery, and had brought the vague possibility of commercial electric lighting to a near possibility. Then a practical demonstration that there were no insuperable engineering difficulties, such as lighting the Centennial buildings, did much to teach the public that the general use of electricity for lighting purposes depended simply on the cost of production.

The educational influence of industrial expositions is, in certain respects, greater than that of any other institution. If we stop to consider the amount of money that is spent on the electric bell work of an average city house at the present time, we are forced to admit that the cause lies deeper than the improvements in electric bells, for we had good, reliable bells 10 or 15 years ago, and although there have been improvements in bell work in that time, they have not been in any sense commensurate with the increased use. The fact is that the general interest in things electrical has led people into the habit of wanting every thing done by electricity, and when builders discover that intending purchasers or tenants want electric bells they begin to install them as a matter of course, even in cheap houses, along with plumbing and other so-called necessities.

So the public has become educated up to the electric light, and for several years past it has not been altogether a question of whether electric light was cheaper than other methods of illumination, but whether it is sufficiently cheap to warrant its general use.

At the time of the Philadelphia Exposition, in 1884, electric lighting was the principal electrical industry outside of telegraphy and telephony. The electric railway, which has now placed the horse on a higher level of usefulness, was not known commercially until several years after this exposition.

The central station system was not sufficiently developed to make a very large use of motors possible, but three or four years saw a great change in this respect also.

About this time the average man began to tell every one he met that "electricity is in its infancy." This was interpreted by the initiated to be a sure indication that electricity had already passed that stage of its existence, but it, nevertheless, expressed a fact, owing to its popular appreciation, the commercial uses of electricity were rapidly growing, and would continue to grow for some time to come. After the Philadelphia Exposition electricity became one of the most important features in every exposition which followed, although there have been no more purely electrical expositions in this country until the present one. In Chicago, at the World's Fair in 1893, it was generally agreed that the electrical exhibit was not confined to Electricity Building, but extended over the entire grounds. The electric fountain, the intra-mural railway, the ubiquitous electric light, the electric launches, and many other uses of electricity made this true. Mr. Preece even went so far as to say that for him the electrical exhibit began at New York, where he landed from the steamer, and reached all the way to the White City.

The most interesting feature of the Frankfort Electrical Exposition of 1891, and one which produced perhaps as great stimulus in polyphase work as the exposition in Paris in 1881 did to the direct-current interests, was the three-phase transmission from Lauffen to Frankfort, a distance of 110 miles.

At Chicago, in 1893, it was hoped that Niagara power would be on tap, but such was not the case; the present exhibition, however, will have that feature, which though somewhat belated will be none the less interesting.

In the two decades which have elapsed since the telephone was shown at the Centennial Exposition, there has been a wonderful development in electricity. Before that time the only great electrical industry was the telegraph. Next in order came electrotyping and electroplating; then burglar and fire alarms and other bell works. The other applications of electricity, such as recording instruments, were scarcely on a commercial scale. The first decade, dating from the Centennial of 1876, gave us the telephone and the electric light, and the second decade the electric railway and electric transmission of power. Beside the larger industries there have grown up many of lesser importance, but which have greatly increased in magnitude, as, for instance, electro-deposition of metals as a refining process.

The present exposition will be in marked contrast to previous electrical expositions, and those who may recall the principal electrical exhibits of 1876, will have brought vividly before them the wonderful progress of the past two decades.

Street Lighting Convention.

Arrangements are now about perfected for a convention of the superintendents of street lighting from all parts of the United States, to be held in New Haven, Conn., in June. The plan is to have a two days' meeting of all the street lighting officials and authorities, for the benefit and mutual aid of every city which sends delegates. This will be the first convention of the kind held in the United States.

Little Economies in Central-Station Practice.*

BY THOS. G. GRIER.

A number of letters have been written to central-station men for suggestions on this subject, and the paper as presented will be mainly a compilation of the points given in this correspondence.

A superintendent from the far West writes: "My experience is, have a man in charge of your plant whom you can trust, and who knows his business, pay him what he is worth; then, having such a man, impress upon him to practice such 'little' economies as keeping his machines covered while not in use, keep his oil exits well guarded by dashes and oil-pans, have a place for everything and everything in its place; remedy a defect while it is small and don't wait until he has to; have a good oil filter, and use it. There are a hundred other small things that will in the long run amount to a great deal more than a person would think."

Two men from different parts of the country write that ashes or cinders can be sold, as they are good for roadways and filling; one of them states that his company receives 25 cents a load for ashes.

The wetting of coal is for the purpose of laying the dust, and it should not be carried to excess, as all the superfluous water has to be evaporated, and uses up so much fuel without doing any good. One man writes that $50 or $60 spent for a platform scales for the boiler-room will, if intelligently used in weighing coal and cinders, soon pay for itself and teach one the most economical fuel for the purpose.

Several engineers write that they get the best results from their fuel by firing light and at frequent intervals. Another advises against forced firing, as it may damage the brickwork of the boilers by forming clinkers. Automatic fire doors, which are easily opened and close themselves, reduces to a minimum the amount of air rushing over the top of the fire.

A good fireman is an investment that pays, not only in the fuel he may save, but in the care which he will give to the apparatus under his charge.

All water contains impurities which may form scale—a thickness of 1-16th of an inch will increase the demand for fuel for the same results about 10 to 13 per cent. For this reason it is economy to either use a mechanical purifier or ascertain what chemical re-agents (boiler compounds) will neutralize the scaling effect of the water. It is economy to keep boilers clean.

Feed-water heaters are recommended, and perhaps would come under the head of large economies. One man states that the introduction of a heater made a saving of over 10 per cent in fuel.

Pumps should be examined; the packing becomes worn, and instead of pumping water they churn it. Leaks in water pipes may not be much, but should always be attended to. In one case, where the leaks were in a cheap heater, the water-meter from the city mains showed 121 cubic feet per hour, and another meter on the boiler showed only 98 cubic feet, making a loss of 23 cubic feet.

An engineer of considerable experience says that the water when pumped into the boiler so as to maintain a uniform height at all times gives the most economical results. He also advises covering all live steam pipes; all pipes to have as few turns and to be as short as possible, and never permit the smallest leak. The same opinion was also expressed by others, one stating that enough steam to run a 10-hp engine was being lost when he first took the matter in charge.

I will quote from a letter: "Since putting the plant in this village, ——, we have had considerable trouble with our engine, and when your engine don't work right, everything is turned upside down; it takes twice as much oil and more coal to run it."

Another letter reads as follows: "It is well to look into the condition of the valves of high-speed engines; many of this type have piston valves which are very seldom tight after a year's use. We have a 40-hp engine which was originally in a Chicago restaurant, the steam consumption of which was cut down almost one half when a new valve was put in."

Leaks about piston or cylinder mean expense, and this applies equally to any make of engine. The adjustment, also, of a valve is a matter of consideration.

Quoting again from my correspondence: "The use of oil appears to be a small item in a small plant, but there is a good chance of economy there. We now use one fourth the lubricating oil we did some months ago"; this plant has been using an oil filter for two months. I find that every plant that has used an oil filter advises others to do so. One company has a home-made filter of sawdust and charcoal; others have different patented devices."

The secretary of a well-equipped station, writes:

"Our plan of oiling dynamos is as follows: We have an oil reservoir from which overhead pipes run to each machine. The pipes extend downward and have an opening directly over oil cups; this makes clean work and is very convenient. We have two good filters and all oil is filtered over and over again. We have had this simple rig in use about two years and it reduces the expense for oil and waste one half. In February the entire expense for oil and waste was $7.35 for the following machinery: Two each a 60 and a 120 alternator, five 50-light arcs, one 90 and one 150-kw generators, with all shafting, clutches, etc. The expense for oil is less than $100 per year."

Another station manager writes: "I think the most saving made is in using an oil filter. With 17 arc dynamos, three alternating dynamos, each with separate exciter, and one 50-hp generator we use three barrels of oil per year. Ten of the arc machines run all night and one incandescent dynamo day and night. A good oil will stand filtering a number of times."

Oil out of place is not a good thing; one spot of oil or grease on a pulley makes the pull of the belt less. One central station reports that this cause made it impossible to keep its dynamo up to voltage until discovered and remedied. The tension on the belt, if released when the dynamos are not running, increases the lite of the belt. Observe carefully the tension of the belt when the dynamo is running, as too great a tension deteriorates the belt, defects the shaft and heats the bearings.

Cleanliness decreases expenses, makes accidents less frequent, and should be strictly enforced. Dirt is a great enemy to electrical machinery and instruments and a cause of fire.

A good method of cleaning dynamos is employed in a station in Wisconsin, and might be adopted by others with profit. A pump forces air into a small compressed-air reservoir; from this reservoir small pipes run to the dynamos. There are valves near each machine. A small rubber hose with a nozzle is attached to any pipe, and in a minute the dirt in or on a machine can be blown away. This cleans parts that cannot be reached by the hand and saves repairs.

Two stations give suggestions in regard to brushes. One states that on their arc machines they use two five-fingered and two six-fingered brushes on the commutator, which makes the wear even, no ridges being cut in the commutator.

Certain types of dynamos have carbon brushes bearing straight or end on the commutator. The springs which feed these brushes come to the end of their travel while 1½" of the brush is still left. One electrician writes: "We added an extension on one half of all the springs in the station and transferred the partly worn brushes into a position underneath these springs, giving an additional ⅝" wear thereby. This amounts to a saving of 9 cents per day.

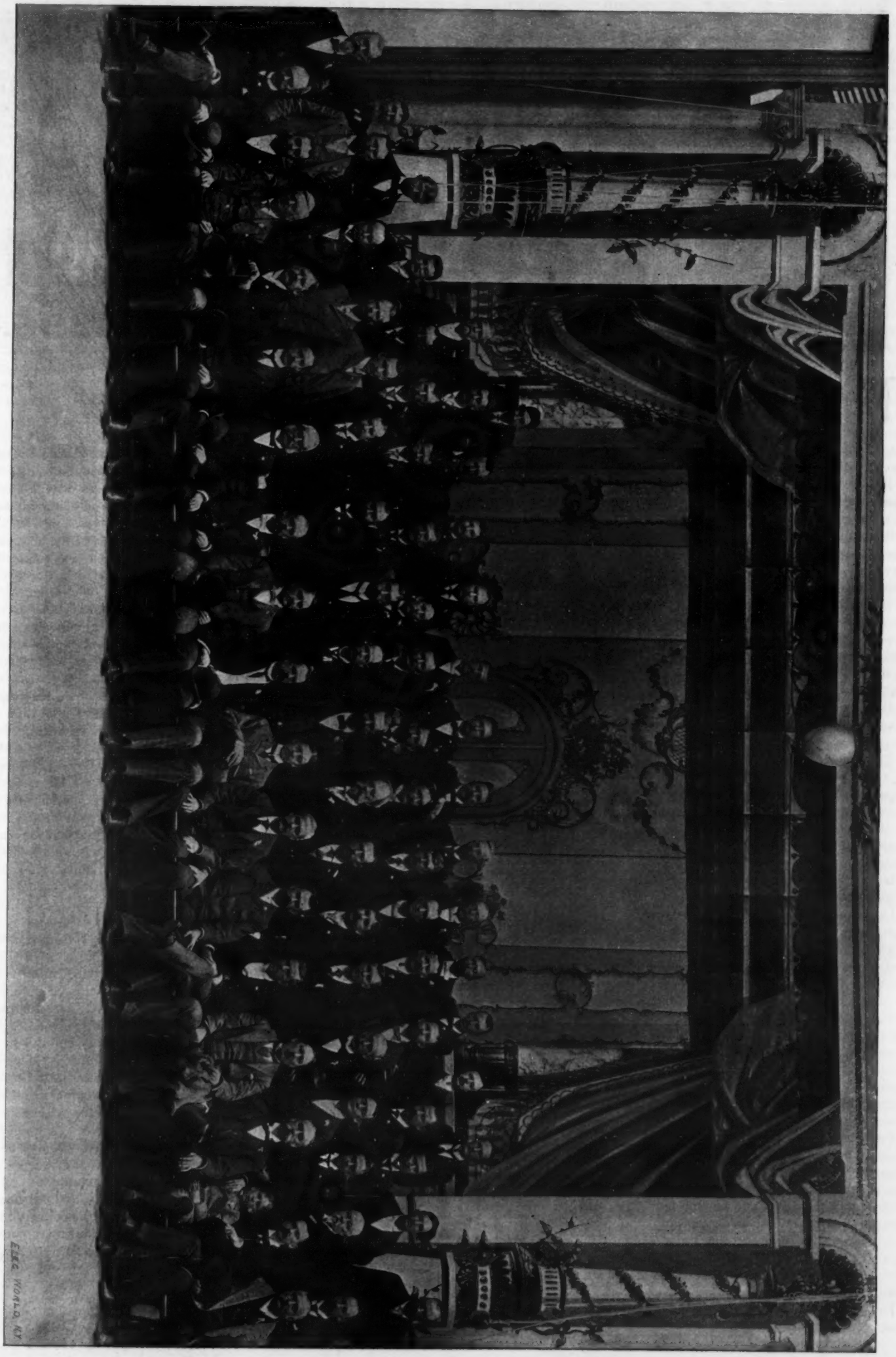
"In the matter of carbons, we have found that by putting a stop in the upper carbon holder, so as to prevent the insertion of the carbon any further into the holder than is absolutely necessary to make it secure, we can eliminate the irregularities of adjustment by different trimmers, and thus can burn the carbons to the last quarter of an inch without danger of any lamps being extinguished before daylight by a short supply. With this device we combine a slight reduction of the current after midnight, just enough to keep our double-carbon lamps at the normal voltage instead of permitting them to burn high, as such lamps do if the current is kept full during the latter part of the night. The result is an economy of $3 per day in carbons as against the corresponding lighting hours of last Fall. The stop appears to be a trifling item, but it secured the certainty of carbons lasting the calculated time."

Up to a year ago another company used 12-inch carbons only and for the lower carbon the trimmers were compelled to break the 12-inch carbon in two, and the result was that much was wasted; they now use 7-inch and 12-inch and find it a saving. High-grade carbons for arc lights in stores are found to give better results. In a station having 400 street arc lamps that run all night, during the months of May, June, July and August the lamps are trimmed every other day.

By patrolling all outside circuits at least once a week grounds and short circuits will be forestalled and rebates saved. One station having a large number of city lamps has two night inspectors, who patrol the circuits in wagons and carry a couple of lamps with them to replace any that are not burning, thus preventing a rebate to the city.

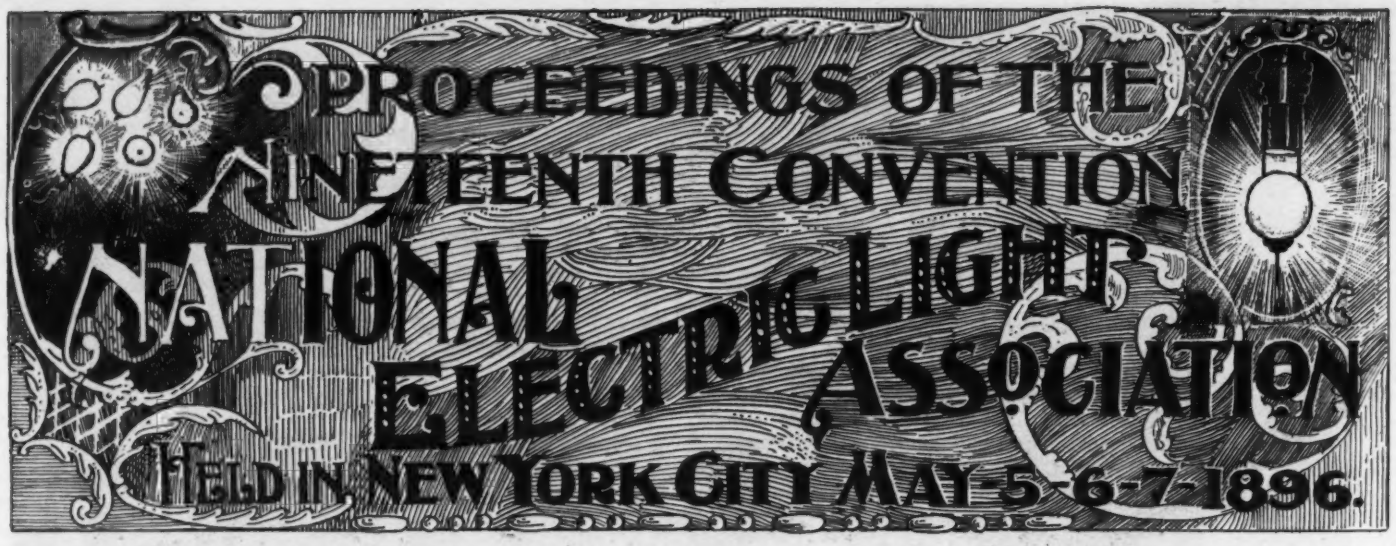
(To be continued.)

* Read before the Chicago Electrical Association, April 17, 1896.



(Copyrighted by Prince.)

SOME WHO ATTENDED THE CONVENTION.



THE nineteenth convention of the National Electric Light Association has passed into history as one of the most successful ever held by that body. The meeting was marked by conditions of the most favorable character, resulting in a large attendance, many of the visitors bringing their families with them to enjoy the delights of a visit to the American metropolis.

It was manifested on all sides that the members are proud of their association and its standing among bodies of its class. It is much to their credit to state that they attend their annual conventions principally for business purposes, and that they attend to business was evidenced by the large attendance at every meeting. They have but one primary object in view and that is to learn from the experience of fellow members and relate their own experiences.

The association includes some very bright men, men who are quietly wrestling with the problems that are continually being developed in their every-day experience, and when they have mastered the difficulties they express their loyalty to their association by coming to the conventions and telling of them for the benefit of others who are seeking information.

It is questionable whether the papers read at the convention, taken as a whole, were up to the standard, but some of them were without doubt both valuable and interesting.

The acetylene gas question has for a year or more disturbed the minds of electric light men, but Mr. Ferguson's able paper served to set them at rest as to the value of this product. It was one of the best treatments of the subject yet produced, and proved beyond doubt that under present conditions there was nothing to fear in respect to this gas becoming a rival of electric illumination. The members were evidently well pleased with the information, and attested this sentiment by ordering the secretary to print the paper in pamphlet form at once for general distribution.

Other papers deserve special mention, but they receive consideration in the regular report of the proceedings which follows.

The question of the relations between manufacturing companies and central stations has not received much attention at the hands of the committee in late years, but there is now an evident disposition to take it up and make it a subject of prime importance in the work of the association. Some plain language was used in the discussion on this subject, which had the effect of materially awakening the members.

Outside of the convention itself the most important coincident feature of the gathering was the exhibition of electrical apparatus and supplies of every kind. This display has been carried out on most extensive lines, and surpasses in many respects anything ever before attempted. The location of the exposition is most favorable for such a display and the exhibitors themselves deserve a great deal of credit for the remarkable amount of enterprise shown. Although this is based on commercial reasons, the fact remains that they have gone to great expense and trouble in making an attractive display. The exhibits include almost every application of electricity, and the excellence of finish of the apparatus is one of the most notable features of the exhibition, and indicates that manufacturers appreciate the importance of giving attention to the æsthetic as well as the material parts of their products.

The convention and Exposition will doubtless be recorded as the most successful of their kind ever held. A comprehensive report of the proceedings of the three days' convention follows.

FIRST DAY.

TUESDAY, MAY 5.

MORNING SESSION.

In opening the nineteenth convention of the association President Wilmerding, who presided, said that owing to the inability of his Honor Mayor Strong to be present, the members would have to forego the pleasure of following the usual custom of being welcomed by some city official and simply welcome themselves.

President Wilmerding in his opening address to the convention said that about 17 years ago the first central station was established, and at present there are some 2500 electric light companies in the United States, and about 200 municipal plants. These central stations represent an invested capital of $300,000,000. Besides these there are 7500 isolated plants, representing an investment of $200,000,000. The daily production of incandescent lamps amounts to from 50,000 to 75,000 and the annual consumption of carbons in arc lamps reaches the figure of 200,000,000.

The electric railway, although of more recent birth, has reached such an extensive application that there are no less than 900 in this country, using some 11,000 miles of track, operating 25 000 cars, and representing an investment of about $750,000,000, an investment which is annually increasing at the rate of $100,000,000 for new roads and new equipment. These, although large figures, do not at all represent the capital invested in large industries. As against these 900 American railways, there are less than 100 in all Europe. President Wilmerding stated that since the last convention the first elevated electric railway had been started, and had since demonstrated that such a road can be operated at about one half the cost of a steam road, thus making it merely a question of time, and a short one at that, before all elevated trains must be propelled by this means.

The report of the Committee on Rules for Safe Wiring not being complete it was held over until the next day.

Upon the president calling for the report of the Committee on Relations between Manufacturing and Central Station Companies, it was learned that this committee had never met. Mr. Beggs, in criticising this action, said he believed that there was a great deal to do for the central-station companies in this country in connection with the manufacturing and parent companies. He thought it of prime importance for the members of the association to consider the subject of the relations between the members and those from whom they are compelled to obtain apparatus with which to run their stations.

He considered that the object of the committee was not, as Mr. De Camp had stated, simply to take up some personal grievance that may be sent to the committee by some isolated company, but that it should take up the broad question of the honesty and fairness of manufacturing and parent companies throughout this country in going into the territory simply for the purpose of exploiting apparatus and of wrecking capital. The motion of Mr. De Camp discharging the committee was carried.

AFTERNOON SESSION.

After calling the meeting to order at 3 p. m., President Wilmerding read several communications from different gentlemen. Mr. Nikola Tesla and Mr. Thos. D. Lockwood thanked the Association

for the invitation to be present; the American Surety Company extended the members and friends the privilege of the roof of the company's building on Saturday afternoon, from which eminence a fine view of the city and surrounding country could be had; R. R. Bowker, vice-president of the Edison Electric Illuminating Company, extended an invitation to the members to visit the company's Duane Street station; also the steam turbine plant at the Thirty-ninth Street station; the Crocker-Wheeler Electric Company invited the delegates to visit its works at Ampere, N. J., on Thursday evening, providing for the purpose a special train.

Mr. L. A. Ferguson then read his paper on "Acetylene Gas." Mr. Ferguson began by stating that the title was not quite correct, and he would change it to "The Commercial Value of Acetylene Gas as an Illuminant." He described the process of producing calcium carbide from which the gas is manufactured, and the plant at Spray, N. C. On May 15, 1895, the author, together with Mr. George O. Knapp, of Chicago, T. L. Willson and Major Morehead, of Spray, carried on a test to show the actual production of calcium carbide per horse-power per day, and the volume of acetylene obtainable per pound of carbide. This test showed a production of 11.12 pounds of carbide per kilowatt per 24-hour day, or 8.3 pounds per horse-power per day of 24 hours; and a yield of 5.24 cubic feet of acetylene gas per pound of carbide. Mr. Ferguson next described the method of producing acetylene from the carbide and gave figures in detail showing the cost of producing the carbide. Compared with water gas when burning at the rate of five cubic feet per hour, which gives from 20 to 25 candle-power, acetylene, burning at the same rate, gives 240 candle-power—about 10 times the illumination of water gas. The temperature of the acetylene flame is low as compared with that of water or coal gas; and when pure the gas is not poisonous. Regarding the cost of production, Mr. Ferguson gave some interesting figures, the substance of which showed that the cost of producing one ton of calcium carbide at Niagara Falls in a plant having 10 200-kw furnaces with a capacity of 10 tons of carbide per day was $34.69; delivered in New York, Philadelphia, Boston or Chicago it would be $37.69. The cost per candle-power-hour of pure acetylene was about 20 per cent. higher than that of ordinary illuminating gas. The cost of producing carbide by central stations as a by-product he stated was prohibitive. It would be much better and more economical to sell electrical energy through the incandescent or arc lamps at the same price per kilowatt than to use the energy in producing carbide. Mr. Ferguson concluded his interesting paper with the assurance that, in the light of present knowledge, acetylene gas should not drive the incandescent and arc lamp from the lighting field, nor materially affect the earnings of visiting central stations. (A further abstract of this paper will be found in another column.)

On motion of Mr. John I. Beggs a vote of thanks was extended to Mr. Ferguson, and the secretary ordered to print the paper in pamphlet form with the least possible delay for distribution among the members of the association.

The next paper read was that by Mr. F. H. Leonard, Jr., on "Single-Phase Self-Starting Synchronous Motors." Some of the principal features to which the author called attention were that many stations, owing to the advisability of having a larger day load, were furnishing current for motor service at 50 per cent. of the price for lighting, and even at this figure found that the motor business became profitable. Mr. Leonard maintained that these alternating-current motors now made to operate in the single-phase circuits for ordinary lighting transformers, without the use of special starting devices, condensers or connections, not only equal the best direct-current motors in commercial efficiency but are superior to them in point of regulation, reliability and freedom from burn-outs. With such a motor, which, he said, could also be used as a rotary transformer, the single-phase alternating system has every advantage of the low-tension direct-current system and is at the same time more simple, flexible, and adaptable for long-distance distribution.

Although attempts have been made to use induction motors on the single-phase circuits, they require expensive arrangements for developing a small starting torque. It was also necessary to have a very small clearance, even as small as one-quarter mm, in order to make such motors efficient, and at the same time to keep the power factor within reasonable limits.

Alternating-current generators may be used as synchronous motors, providing the fields are separately excited. Such motors have the highest efficiency, and at the same time perfect regulation. The load is practically non-inductive as long as the proper excitation is maintained. By over-exciting it may be made to perform the office of a condenser and compensate for lag or inductive load, and can even induce a negative lag, thus raising the E. M. F. of the line.

Its drawback has been its inability to start excepting by separate means, and would not carry its load up to speed. Mr. Leonard stated that with the type he was considering these difficulties had been overcome, giving greater torque at starting than when running in sychronism. This is accomplished by having two windings on the armature, one of which is distributed and connected to a commutator similar to that of a direct-current motor, which in this motor is used for starting and exciting the field. The second winding is of the shuttle type, and performs the work of rotating the armature. The motor is started by the simple throw of a switch, the self-induction of the windings preventing an abnormal flow of current. Upon the first throw of the switch the alternating current reaches the commutator brushes, thence through the distributed armature windings and thence out by the opposite brushes to a coarse field winding as in a direct-current series motor. When synchronism is reached, the switch is reversed, the alternating current charged from the commutator brushes to the ring brushes of the shuttle winding, the commutator brushes being at the same time connected to the shunt field windings, magnetizing the field with direct current. The magnetic circuit is composed of sectional sheet iron punchings and is of the multipolar type. The limit in capacity of this type of motor was not mentioned.

In the discussion on Mr. Leonard's paper Mr. Wagner inquired as to the effect of switching at the central station on the operation of the motor when running at full load. In reply Mr. Leonard stated that if a motor fully loaded has the current switched off it will slow down to a point so much below synchronism that it is impossible to go on, unless the switch is reversed so as to put it in the position of starting. Mr. Van Trump asked if there was not difficulty in operating these motors due to a difference in the curve; that is, in the wave line of the motor differing from that of the generator. Mr. Leonard stated that owing to the method of winding these motors the wave-line made no difference.

After further discussion of a general character Mr. A. Churchward read a paper on "Equalizer Systems of Distribution." (An abstract of this paper will be found elsewhere in this issue.)

Mr. C. L. Edgar opened the discussion. Every one of these systems, he thought, would go to pieces if the neutral wire got on the outside wire and all the lamps on that wire would burst. This, however, Mr. Churchward denied. Mr. Edgar thought that the equalizer should have an ampere capacity equivalent to the total ampere capacity of the station. Mr. Churchward said this was obviated by winding the equalizer with a large wire; a very small wire will stand a tremendous current, and the equalizer will stand an overload. His object was to get around the standard three-wire system. In reply to other inquiries Mr. Churchward stated that his system contemplated placing small equalizers in each large block, and not in the central station. The system is intended as a method of avoiding the three-wire system, irrespective of economy.

The meeting then adjourned until Monday morning. An executive session was called immediately after adjournment, and it was adjourned until the close of the Wednesday morning session, in order to give the members an opportunity to attend Mr. Max Osterberg's lecture on "The Rōntgen Ray," which was to be given at 8 o'clock Tuesday evening.

SECOND DAY.

WEDNESDAY, MAY 6.

The morning session, called to order by the president at 10.30, was occupied in the reading and discussion of the paper by Mr. Emmet, on "Results Accomplished in Distribution of Light and Power by Alternating Currents." A full report of the paper, together with the main features of the discussion, will be found elsewhere in this issue. Mr. Emmet referred to the half-hearted development of alternating-current systems, and stated that the introduction of successful polyphase motors constituted a radical and important step in the development of the electrical art.

The reasons for the slow development spoken of were low average efficiencies of most plants, imperfect distribution of potential, the absence of reliable alternating arc lamps, and the absence of a practical form of single-phase alternating-current motor.

He described in considerable detail some of the means by which these difficulties have been and can be avoided.

Touching on the subject of alternating-current motors, he stated that the mechanical features of the motor are near perfection. With these improved facilities for electric power transmission great developments in the sale of power from central stations might be looked for. He then gave some facts concerning the sale of alternating-power apparatus by one company alone, to illustrate how readily improvements are taken hold of and adopted.

By the aid of several diagrams the speaker described the different methods of distributing power and light by alternating currents, and reviewed some of the applications of the systems now in general use.

Mr. Emmet closed his paper by stating that the question of electrical distribution must be carefully studied in each case, in order that money may be invested to the best advantage.

A general discussion followed the reading of the paper, Messrs Wagner, Scott, Dow, De Camp and others participating.

Mr. Scott said that he wished to reinforce the statements made by Mr. Emmet in regard to the flexibility of alternating systems. The Hartford plant, which was cited as an example, is an exceedingly good one.

Mr. Dow wished to know whether anything was to be expected in series arc lighting on alternating circuits supplied at the same time with incandescent lamps and motors.

Mr. Wagner said that steps were now being taken to accomplish this, and that 75 arcs were now being supplied on such a system, and apparently giving good satisfaction.

Mr. Ayer said that the question of economy was the point to be considered. He wished to know what was considered to be the practicable limit in the relative proportion of arcs, incandescents and motor supply.

Mr. Dow observed that series alternating-current lamps were now a commercial success, and give as little trouble as the direct-current type. He said that the rectifier had been used in England for some four years, and that a possible efficiency of 73 per cent. from the indicated horse-power of the engine to the kilowatts delivered had been obtained. Mr. Emmet said that the rectifying of alternating currents was analogous in its nature to commutating in ordinary arc machines. The rectifier introduced considerable self-induction into the circuit, thus introducing idle currents.

A letter was read by the president from Prof. Thomson in which the professor stated that he had met with an accident, thereby making it impossible for him to attend the convention.

The session then, at 12.55, adjourned until 2.30 p. m.

AFTERNOON SESSION.

Vice-President Nicholls called the meeting to order. Judge Armstrong read a paper by Luther Stieringer on the "Evolution of Interior Conduits from an Electrical Standpoint," Mr. Stieringer not being present.

The paper treated first of the use of piping in gas fitting, then in plumbing, third in steam heating, and finally in electrical distribution. Mr. Stieringer states that tubes and conduits for the latter purpose are to be considered merely as raceways, and are not to be relied on for insulation between wire and wire, or between wire and the ground, as defined by the National Board of Fire Underwriters.

He then took up the historical development since 1881, mentioning the use of speaking tubes for conduits in 1887. About the same time a twin conductor was evolved with practically no insulation, the idea being that in case of trouble it would most likely be a short circuit and blow the fuse. The next important step was the use of plain iron pipe for conductors carrying 2000 volts within the World's Fair buildings, the insulation of the conductors being relied upon entirely for the protection. This proved a remarkable success. Mr. Stieringer states that the best practice has demonstrated that lead-covered wires, except where protected in a conduit, are condemned. Insulated tubes covered with a thin coating of brass are admissable to a certain extent in exposed places. Heavy insulated covering, integral with the insulation, offers no absolute protection against injury, and is analogous to rubber tubing for gas distribution installed throughout a building.

Concentric wiring is practiced in England with satisfactory results, but is not in use in the United States. It offers many possibilities in the direction of a solid and fixed system.

Paper-lined iron or steel pipes and plain iron or steel pipe, are the only conduits that can afford absolute security against mechanical and chemical injury and assure permanence.

A vote of thanks was extended to Mr. Stieringer, and owing to his absence the paper on "The Evolution of the Inductor Alternator" was read by Mr. Kelly. The paper consisted of an historical review, confined mostly to English invention of the inductor generator from its inception by Knight in 1854, through the stages of development brought about by Wheatstone, Lippens, Martin, Henley, Holmes, Mordey, Kingdon, Kennedy, Pyke, Harris and Thomson ending with the type partly after the author's designs.

Mr. Kelly stated that Mordey cut the Gordian knot by entirely suppressing the iron in the induced portion of the machine. In this design the total reluctance of the circuit remains the same, while the change of flux in the iron is due only to armature reaction. With a low armature reaction, therefore, the losses in the iron may be extremely small. Mr. Kelly called attention to the peculiarity of single induced coil machines like the earlier of the Mordey types, that with any given frequency the output is independent of the speed; or, in other words, the only limit to reduction of speed is the possibility of further sub-dividing the poles.

Mr. Kelly then mentioned the type designed by Prof. Elihu Thomson, the first machine on the inductor principle adapted to polyphase construction. In describing the machine, in the design of which he himself assisted, Mr. Kelly said that the exciting coil was wound inside a cast copper ring, which was placed between the pole pieces of the rotary conductor, the ring and exciting coil, however, remaining stationary.

This cast copper ring serves also the purpose of preventing the production of excessive E. M. Fs., either in the armature coils or the inducing coil, should the exciting current be broken. Mr. Kelly said that an important advantage possessed by inductors was the possibility of regulating separate circuits or feeders with little or no auxiliary apparatus, since it is possible to tap the armature coils at any point and thus be able to obtain any desired E. M. F. Circuits and feeders having different drops may thus be provided for. This allows of flexibility and ease of control of individual circuits and at the same time offers a lower first cost and greater economy of operation of larger machines.

Dr. Bell opened the discussion by saying that it was possible to add a number of types to those shown in the paper. He was most interested in the reference to the sine wave controversy. He said that as nearly as he was able to figure, the position taken by those interested in the development of machines which give particular forms of wave, was that the form of wave given by their machine was the very form that the public wanted. He said that a possible explanation for the discordant results is that owing to the presence of harmonics the average frequency is a little higher in actual working than the fundamental, thus making the effect on a static transformer the same as using a pure sine wave of a little higher frequency. Although an increased efficiency has been found in the case of static transformers when subjected to a distorted wave over the same receiving a pure sine, nearly all experimenters agree that with induction motors the sine wave is better. This may be explained by saying that by taking a motor designed for a given frequency, and thrusting upon it energy at a higher frequency, it cannot work so effectively as it would for the frequency for which it is designed.

THIRD DAY.

THURSDAY, MAY 7.

The morning session was called to order at 10.35 o'clock by the president. Mr. Armstrong moved that a committee of five be appointed to make nominations for new officers. An invitation for the association to send a representative to attend the jubilee meeting given in honor of Lord Kelvin was read. The president announced that he had already appointed Mr. T. C. Martin to represent the association, owing to the necessity of immediately acting upon the invitation when received. This action was endorsed by the convention; at the same time Mr. Martin was authorized to prepare resolutions in honor of the celebration. Mr. Seely, chairman of the Finance Committee, announced that a balance of $738 was on hand, and that the assets of the association are $1793; number of active members 111, and number of associate members 90. By a motion of Judge Armstrong, the report of the committee was accepted. A very lengthy discussion ensued as to the time which should be included in the report of the Finance Committee. The reports made have been brought down to the first of the calendar year. It was decided, as a result of this discussion, that the report should be made to include the financial report up to and within three days of the meeting of the convention. The president nominated a committee to confer with the American Institute of Electrical Engineers, for

the purpose of determining the standard candle-power for incandescent lamps. The committee consisted of Louis Bell, chairman; James I. Ayer and Louis A. Ferguson. The Committee on Standard Electrical Rules is now to be William J. Brophy, chairman; C. B. Barnes, William J. Hammer, James I. Ayer and C. L. Edgar.

The report of the Committee on Data was then presented. This report presents a tabulated statement of watt-hours produced per pound of coal from 82 central stations using coal as fuel and from one using crude oil, and it states that they are able to show the class of equipment from all boiler tests from 32, and engine efficiciency from 8. The committee has constructed load lines from the information furnished by 22 of the stations reported. Economies are given from a number of the largest electric stations in the country, five of them having an output of over 10,000,000 watt-hours per day, and 45 of them having an output from 1 to 10 million watt-hours per day. Four of the large stations represent a production of 94,270 kw hours, and a consumption of 524,667 pounds of coal, or 179 watt hours per pound of coal. The aggregate output of the 49 large stations reaches the production of 212,617 kw-hours in one day at an expense of 1,316,703 pounds of coal, or an average of 161 watts per pound of coal. The aggregate output of 32 smaller stations, those producing less than one million watt-hours per day, represents a production of 11,973 kw-hours, with an expenditure of 194,274 pounds of coal, or 62 watt-hours per pound of coal. The average

TABULATED REPORT FROM ELECTRIC LIGHT STATIONS, SHOWING WATTS PER POUND OF FUEL, EQUIPMENT, EFFICIENCY, ETC.

No. of Report	Hours in Run	Watt Hours, One Day	Coal Used, One Day Lbs.	Watt Hours Per Lb. Coal.	Fuel—Kind and Grade.	Equipment. (See Foot Notes)			Boiler Test. Evaporation			Engine Test. Water per hour per I. H.P.	No. of Report
						Engines.	Boilers.	Dynamos	Per lb. Coal.	Per lb. Combustible. Actual.	Per lb. Combustible. From and at 212°		
1	24	3207392	11600	237	Bit. Lump.	D	C	V	6.2	6.87	7.12	—	1
2	24	2397712	11251	213	Bit. Lump. [Screenings.	D	C	V	5.7	6.45	6.69	—	2
3[1]	24	26402256	124383	212	½ Ea. Soft Coal and Hard	A	A	A	7.38	8.81	10.22	18	3[1]
4[1]	24	5063165	28050	180	½ Anth. ½ Pea and Dust.	B	1A, 5C	B	8.91	—	—	36 9	4[1]
5[2]	24	1818780	10200	178	.4 Coke .6 Coal.	CD	C	V	5.4	5.75	6.41	27.6	5[2]
6	24	11488509	65884	174[6]	Bit. Run of mine.	BDz	C	V	—	—	—	—	6
7	24	1212900	7105	171	" " "	B	C	V	—	—	—	—	7
8	24	825000	5022	164	Bit. and Hard Screenings.	Ex	C	V	10.35	11.48	—	—	8
9	24	4270077	26600	161	½ Anth. ½ Dust and Pea.	B	1A, 5C	V	9.17	—	—	42 2	9
10	14	1718000	11400	151	Bit. Va.	BC	C	V	—	—	—	—	10
11[3]	15½	1188500	5500	151	" "	CD	A	Alt.	—	—	—	—	11[3]
12	24	2156000	14493	149	Buckwheat.	3C, 1E	C	Alt.	8.99	10.34	11.23	—	12
13	14	1625000	11440	142	Bit.	BC	C	V	—	—	—	—	13
14	18½	711720	5100	140	Bit. Slack.	D	C	V	—	—	—	—	14
15	16½	727720	5200	140	Bit.	D	C	V	—	—	—	—	15
16	14	1624000	11840	137	Bit. Run of mine.	BC	C	V	—	—	—	—	16
17[3]	14	2734976	19900	137	Slack.	Dx	B	V	8.25	8.9	9.43	—	17[3]
18	14	2599705	19050	136	Slack.	Dx	B	V	7.92	9.35	9.9	—	18
19	14	1526000	11200	136	Bit. Run of mine.	BC	C	V	—	—	—	—	19
20	14	1560000	11600	134	" " "	BC	C	V	—	—	—	—	20
21	14	2722463	20350	134	Slack.	Dx	B	V	7.8	8.8	9.39	—	21
22[1]	34	16149010	121400	133	Slack and Bit.	B	C	V	—	—	—	—	22[1]
23	16	1528100	11395	131	Bit. Lump.	D	C	V	—	—	—	—	23
24	15½	695720	5300	131	Bit.	D	C	V	—	—	—	—	24
25	16	1549100	11860	131	Bit. Run of mine.	B	C	V	7.7	8.3	—	—	25
26[1]	24	5401900	41924	129	Semi-Bit.	EDx	BC	V	9.5	12.2	—	30	26[1]
27	14	1399000	11200	126	Bit.	BC	C	V	—	—	—	—	27
28	16	1568600	12000	131	Bit. Lump.	B	C	V	7.7	8.3	—	—	28
29	13	2103800	16800	125	Anth. Buckwheat.	Cx	C	C	6.84	8.26	8.73	26	29
30[2]	24	2683008	21571	124	Bit. Nutt and Slack.	Ex	AC	Bl.P.	—	—	—	—	30[2]
31[2]	17½	3396619	27414	124	.....	—	C	—	9.8	9.8	—	—	31[2]
32[2]	24	1763795	15625	113	½ Ea. Bit. and Anth.	EDx	C	B	8.93	10.57	11.02	—	32[2]
33[1]	24	6794304	62504	109	.6 Anth. 4 Bit.	Ex	6C, 5A	BE	—	—	—	—	33[1]
34[2]	24	1193876	10475	106	Anth. Buckwheat.	4C, 1E	C	C	—	—	—	—	34[2]
35	24	1074436	10250	105	" "	4C, 1E	C	C	—	—	—	—	35
36	—	166049988[5]	1533000	104	Bit. Screenings.	BC	AB	—	—	—	—	—	36
37[2]	12½	2202363	22080	100	Lignite, Run of mine.	BDx	AC	Alt.	4.8	5.2	—	—	37[2]
38	—	288440	3041	95	Bit. " "	Ex	C	C	—	—	—	—	38
39[3]	9½	454058	4831	94	Slack.	D	A	V	—	—	—	—	39[3]
40[3]	13	903720	9812	92	Bellwood Bit.	BDx	A	—	5.1	5.6	5 93	—	40[3]
41	—	268800	2896	92	" "	Ex	C	C	—	—	—	—	41
42[2]	24	1444931	20800	69	Slack.	Ex	BC	BC	6.33	—	—	—	42[2]
43	6½	93541	1365	68	Buckwheat, Anth.	E	C	C	—	—	—	—	43
44	8	230187	3600	64	.....	Ex	C	B	—	—	—	—	44
45	14¾	310928	5000	62	Bit.	Ex	C	V	—	—	—	—	45
46[3]	15	254745	4520	56	Bit.	Dx	C	C	—	—	—	—	46[3]
47[3]	7½	186412	3810	49	Slack.	Ex	C	B	—	—	—	—	47[3]
48	24	66285375[6]	1160500	57	Bit.	1D, 2Ex	A	C	—	—	—	—	48
49[2]	14	156800	2800	56	Bit Run of mine.	Ex	C	C	—	—	—	—	49[2]
50[3]	7½	214485	3900	56	Bit.	Ex	C	B	—	—	—	—	50[3]
51	7½	204435	3600	57	Bit.	Ex	C	B	—	—	—	—	51
52[3]	10	6453491[6]	116000	56	Bit. and Slack.	Cx	C	Alt	—	—	—	—	52[3]
53	7½	217228	4000	54	Bit.	Ex	C	B	—	—	—	—	53
54	7	221250	4200	53	"	Ex	C	B	—	—	—	—	54
55	7½	186412	3810	49	Slack.	Ex	C	B	—	—	—	—	55
56	7	208535	3900	53	Bit.	Ex	C	B	—	—	—	—	56
57	6	161458	3150	51	Bit.	Ex	C	B	—	—	—	—	57
58	7½	174928	3720	47	Bit.	Ex	C	B	—	—	—	—	58
59[2]	15	203555	6200	33	Anth. Buckwheat.	E	C	V	—	—	—	—	59[2]
60	14	762825	20700	37	Bit. Slack.	Exy	C	V	5.44	—	—	—	60
61	15½	806880	19300	42	" "	Exy	C	V	5.78	—	—	—	61
62	18	1294708	31040	42	" "	Ex	C	V	4.23	—	—	—	62
63	16½	866235	20500	42	" "	Exy	C	V	5.75	—	—	—	63
64	14	1454656	31739	46	Bit. No. 2 Nut.	Cx	B	V	5.48	6.5	6 85	—	64
65	14½	1881102	31992	59	" "	Cx	B	V	5.8	7 1	7 48	—	65
66	24	194472	3300	65	Wilmington Lump.	(IE, 7C) x	C	C	—	—	—	—	66
67	8	444133	6101	73	Bit. Slack.	Ex	C	V	4 66	—	—	—	67
68	14	1201483	15386	78	Bit.	C	C	Alt.	—	—	—	—	68
69	10	500697	6286	80	Bit. Slack.	Ex	C	V	5 59	—	—	—	69
70	24	5982000	71000	84	Bit. Screenings	(6D1E5Dz)x	A	V	—	—	—	—	70
71	14½	1243441	14224	87	Bit.	C	C	Alt.	—	—	—	—	71
72	14	477425	5400	88	Semi-Bit.	Ex	C	Alt.	9 68	10.7	11 13	37	72
73	24	2879000	31200	92	Bit. Screenings.	Dxz	A	A	—	—	—	—	73
74	13½	1217000	12895	94	Anth.	Ex	C	V	—	—	—	—	74
75	24	1960073	17600	111	Bit.	Ex	C	V	—	—	—	—	75
76	24	3360065	20300	166	½ Ea. Anth. Bit.	B	A	Alt.	6.82	7 89	9 20	—	76
77	24	3373305	20300	166	" "	B	A	Alt.	6.2	7 14	8 33	—	77
78	24	3398595	20300	167	" "	B	A	Alt.	6.6	7.56	8 82	—	78
79	24	40230300	213000	189	Bit. Screenings.	A	A	A	—	—	—	15½	79
80	24	14941089	8700gals	1717	Crude Petroleum.	D	2B, 1C.	B	—	—	—	—	80
81	24	3455988	19100	181	Semi-Bit	(A.D.E)xy	C	V	10.5	—	—	—	81
82	24	5761915	40800	141	3 Slack 1 Nut.	1D, 2B	B	V	—	—	—	—	82

NOTES.—[1], [2], [3] See Load Line Chart [1], [2] or [3], the load line bearing same number as report.
[4]; Average from one years' record.
[5]; Total for one month.
[6]; Per gallon of oil.

Equipment Letters denote classes as follows:

A. Engines, triple expansion condensing. Boilers, horizontal water tube. Dynamos, multipolar on engine shaft.
B. Engines, Corliss compound condensing. Boilers, vertical water tube. Dynamos, bipolar belted from jack shaft.
C. Engines, simple Corliss, or slow speed condensing. Boilers, horizontal tubular. Dynamos, continuous current.
D. Engines, high speed compound condensing, belted direct to dynamo.
E. Engines, simple high speed condensing, belted direct to dynamo.
x. Any of the above non-condensing.
y. Belted to dynamos.
z. Dynamo on engine shafts.

efficiency of the 81 reports using coal as fuel is 108 watt-hours per pound of coal; one report, giving the production from crude oil, shows 1717 watt-hours per gallon of oil.

The 31 stations reporting the water evaporated per pound of coal show a wide range of boiler efficiency not to be accounted for by the difference in quality of fuel. Report No. 81 evaporates 10½ pounds of water per pound of semi-bituminous coal, comparing favorably with report No. 8, each using horizontal tubular boilers, while report 67 evaporates only 4.66 pounds of water per pound of bituminous coal with the same style of boilers, the average evaporation per pound of coal from all the stations giving reports being 7.09. In engine efficiency eight stations report the water consumption per indicated horse-power. The triple expansions lead in economy, report No. 80 showing a consumption of 15½, and report No. 3 showing 18 pounds of water per indicated horse-power, these comparing reasonably with report 29, where an indicated horse-power is produced by non-condensing engines with 26 pounds of water. Report No. 22 submitted at the last convention showing a production of 262 watts per pound of coal, and having the highest economy in the stations mentioned in that report is from the same station as report No. 3, and which in the point of economy stands third on the list, being 212 watts per pound of coal, a showing somewhat inferior to the previous report. The station is reported in a general way as running at greater economy than when the previous report was made. The efficiency figures, however, seem to contradict this statement and to verify the statement in the present report. In the previous report, 9.37 pounds of water were evaporated per pound of combustible, and 17 pounds of water consumed in the engine per horse-power. The present report brings the evaporation per pound of combustible down to 8.81 pounds of water, and the steam consumption in the engine is raised to 18 pounds, which would account for the lower efficiency stated in the present report. Attention is called to the reports from plants running with non-condensing engines, in which report 26 is able to show 129 watt-hours per pound of coal; report 32, 113 watt-hours; report 33, 109 watt-hours, and report 37, 100 watt-hours. In conclusion the committee stated that the economy secured in generating power for electrical work does not compare favorably with the production of power for other purposes, and that this is also true after taking into consideration the variation on load due to electrical work. Referring to a recent statement of the economy of the Chestnut Hill Pumping Station at Boston, it was found that in actual water lifted a horse-power was produced by the consumption of 1.34 pounds of coal; allowing that the efficiency of pumps compares favorably with the efficiency of the generators, and making no allowance for variation in load, one pound of anthracite coal used with the same economy in electrical work should produce 557 watt-hours. The committee advised more careful record, more frequent tests of all apparatus, and a steady application of principles of economy until this record can be made to show more favorable comparison.

Judge Armstrong moved that the report be received and the committee be extended. Mr. Swetland, chairman of the committee, requested that they be discharged. A lively discussion followed as to the most efficient way of carrying out the desired resolution, and it was finally resolved that the Executive Committee be delegated to expend such money as may be necessary to prepare data from the representative companies for the benefit of the committee. This motion was carried.

Mr. Alfred Swan was down on the programme to open the discussion on the "Standard Socket," but was unable to be present, and instead sent a communication which he stated that preliminary to the standardization of the lamp socket a standardization of the lamp base must take place. The standard base involves three elements, electrical, mechanical and economical. Good insulating conditions are of the first importance; mechanical considerations concern the means by which the base is attached to the lamp, and the means by which when so attached it couples with the socket a rigid and unfailing contact, and at the same time should be such as not to put a strain upon the lamp. Cheapness is, of course, a necessity. The use of plaster is objectionable. The present sockets are clumsy and heavy by reason of their size, and are needlessly expensive. The standard should be accepted upon its merits. In view of the fact that high tension lamps are going to be the rule in the future, the question of a safe socket acquires enhanced importance. Porcelain will no doubt come largely into use for this purpose and will make possible a simple and economical change. Mr. Swan stated in his communication that he had arrived at the conclusion that the idea of adopting a base which could be in continuous use was right in theory but doubtful of practical application, owing to the allowances necessary for returns and to cover shipment and other charges. He therefore decided that it was best and cheapest when a lamp is destroyed that the base may be allowed to go with it. Mr. Swan wished to impress upon the convention that a standard base is the kernel of the subject introducing the standard socket such as has yet to be developed, and must be one which shall fulfill in all respects the standard requirements and so give its complement to the standard socket.

The paper of Mr. L. H. Rogers, on the evolution of the arc lamp, was then read. Abstracts of this paper will be found in another column. The paper was listened to with great interest, and was brisk with humor throughout its reading. Judge Armstrong said that it could be considered the cherriest, and prettiest, and most interesting paper that had ever been read at one of these conventions, and he thought that more than a vote of thanks should be offered to Mr. Rogers.

Capt. Brophy then read a paper on "Electrolysis." The paper treated of systems of conductors, both overhead and underground, the early attempts made and accomplished successfully later, and some of the other methods employed to accomplish this purpose. He mentioned numerous reasons for placing conductors underground, including those of public demand and political influence and competition from other sources. He mentioned the corrosion of metals, and spoke of the similar action existing in buried conductors, stating that bonding wires has proved a problem yet unsolved with conductors lying near electric railways acted upon by return earth currents. In conclusion he stated that the authorities controlling electric light companies and other companies should place their conductors underground, and be obliged also to protect this property against any subsequent injury. The meeting then adjourned until 2.30 p. m.

AFTERNOON SESSION.

The president called the meeting to order at 3 o'clock. The first business was the reading of a paper by Mr. Albert C. Carey, on "Steam Boilers and their Management."

Mr. Carey said that a large steam space is not an essential feature in a boiler, a large water capacity being preferable. He outlined a method which he has devised of throttling from a high pressure boiler to the engine by means of one or two reducing valves. Such a method required fewer number of boilers, resulting therefore in more economy in operation. Mr. Carey recommended a mechanically induced draft. He said that it had generally been his experience that those stations paying the best were those having the best boiler equipment. Owing to the lateness of the hour no discussion followed the reading of the paper.

The Convention then went into executive session. The chairman of the Finance Committee made a supplementary report stating that the total cash balance in the treasury of the association was about $5000. It was also decided that the Executive Committee be instructed to require that all papers to be read at the convention should first be submitted for their approval, and if approved that such papers should be printed and placed in the hands of members at least one week before the meeting, when papers should not be read in full except by special order, so that the time occupied by such papers may receive due attention.

The Nominating Committee presented the following names for the ensuing year: President, Frederic Nicholls, Toronto, Canada; first vice-president, Henry Clay, Philadelphia; second vice-president, J. J. Burleigh, Camden, N. J., and members of the Executive Committee for three conventions, A. J. DeCamp, Philadelphia, Pa.; John A. Seely, New York City; A. M. Young, Waterbury, Conn., and H. A. Wagner, St. Louis, Mo. Mr. Wagner was appointed to fill the vacancy made in the Executive Committee by the election of Mr. Nicholls as president.

Mr. Wilmerding, the retiring president, expressed his gratification of the manner in which the convention had passed off and thanked the members for their assistance in contributing to its success. On the motion of Mr. Seely, the secretary was instructed to draw up a set of resolutions for the retiring president for the manner in which he had presided during the year. Mr. Nicholls, the newly made president, presented the motion, which was carried. The meeting then adjourned.

Death of Dr. Nicholson.

Dr. Henry C. Nicholson, who was prominently identified with the invention of the quadruplex system of telegraphy, died at his home near Independence, Ky., on April 30, at the age of 74 years. He received a stroke of paralysis about six weeks prior to his death, from the effects of which he never recovered.

The New President of the Association.

FREDERIC NICHOLLS.

The newly-elected president of the National Electric Light Association, Mr. Frederic Nicholls, of Toronto, Ontario, Can., is one of the most active and highly-esteemed members of that body. Although an Englishman by birth he is an American in spirit, and is thoroughly abreast of the times in everything that pertains to electrical progress.

Mr. Nicholls was born in England in 1856, and finished his education at Stuttgart, Germany, coming to Canada shortly afterward. For several years he has been actively engaged in directing electrical enterprises in his adopted country and with great success. He organized the first and only company in Canada that adopted the underground system of electric light distribution, and is prominently identified with other Canadian enterprises. Those concerns of an electrical character with which he is connected are the Canadian General Electric Company, of which he is vice-president and general manager; the Toronto Electric Light Company, as director; the Brantford Street Railway Company, as president; the Peterborough Street Railway Company, as vice-president; the London Electric Light Company, as secretary, and the Toronto & Scarboro Railway Company, as director. In addition to these Mr. Nicholls is a director in mining, insurance, publishing and other companies of Canada, and notwithstanding the duties of his many positions, he is always able to give time to the affairs of the National Electric Light Association.

He is a regular attendant at the conventions of that organization, and is deeply interested in its work and welfare.

Prior to his election as president of the association, Mr. Nicholls

FREDERIC NICHOLLS.

performed successively the duties as a member of the Executive Committee, and as second and first vice-president.

The association is indeed fortunate in selecting as its official head a gentleman so well qualified to direct its affairs, and one who at the same time enjoys the confidence of his official associates and of the members of the body.

First Vice-President.

HENRY CLAY.

This gentleman, who occupies the second highest office in the National Electric Light Association, is a Philadelphian through and through, having been born in that city on Aug. 17, 1850, and lived there all his life. He was educated in the public schools of his native city. After some experience as a clerk in a conveyancing business he, in 1878, opened an office and business on his own account, in the same line, and became heavily interested in real estate operations. In 1894 he became general manager of the Northern Electric Light & Power Company, but still conducts his real estate business.

Mr. Clay's electric light company has a modern plant in the best part of Philadelphia. The plant has an aggregate of 3200 horsepower, and a capacity of 1815 arc lamps and 20,000 incandescents.

HENRY CLAY.

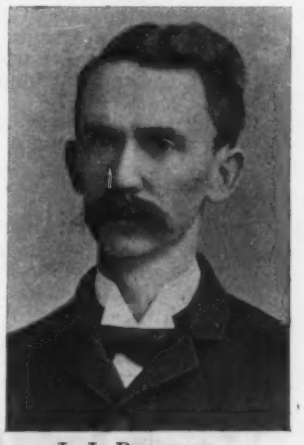
Mr. Clay has been a member of the Philadelphia School Board and also of the Council. He possesses an irreproachable reputation for integrity, and those who know him best aver that he will be a valuable factor in the council of the association.

Second Vice-President.

J. J. BURLEIGH.

Mr. Burleigh was born in Gloucester County, N. J., in 1855, and received his early education in the public schools in Salem, N. J.

At the age of 14 he began the study of telegraphy, and a year later entered the service of the West Jersey Railroad Company (now a portion of the Pennsylvania Railroad system) as station agent and telegraph operator at Elmer, N. J.



J. J. BURLEIGH.

In 1873, at the age of 18, he was appointed chief operator of the West Jersey Railroad Company and leased lines. In 1880, in addition to his other duties, he was appointed assistant trainmaster, and in 1884, trainmaster.

He resigned his position in June, 1892, to give his entire time to other business ventures.

Mr. Burleigh is known throughout Southern New Jersey as a careful and painstaking business man. He has a large clientage who rely upon him for the care of their property and investments.

He is now the secretary and general manager of the following companies, many of them creations of his own, and on a good dividend paying basis: The Cape May, Delaware Bay & Sewell's Point Railway Company; the Camden Lighting & Heating Company, the

Electric Light Company of Atlantic City, the Atlantic Electric Light & Power Company, the Cape Island Gas Company, the Merchantville Water Company, the Telephone Company of South Jersey, the Delaware River Telegraph Company, the North Camden Building & Loan Association, the Economy Building & Loan Association, the Homestead Building & Loan Association, Edison Investment Company. He is also receiver of the Bodine Glass Manufacturing Company.

The Attendance.

The following is a list of the attendance, as shown by the secretary's register:

P. C. Ackerman, American Electrical Works, New York.
John W. Aitken, Carbondale, Pa.
H. F. Albright, Western Electric Co., Chicago.
Chas. W. Allen, Germantown, Pa.
J. A. Almstead, Rochester, N. Y.
H. S. Anderson, United Electric Light Company, Springfield, Mass.
E. A. Armstrong, Camden, N. J.
E. P. Atkinson, New York City.
C. Baechtold, Baechtold & Parker Electric Company, Brooklyn.
F. H. Badger, Jr., Montmorency E. P. Company, Quebec, Canada.
E. L. Babcock, Cuyahoga Falls, O.
C. O. Baker, Jr., New York City.
H. G. Balkam, Washington, D. C.
W. C. Balda, Utica Electrical Manufacturing & Supply Company, Utica, N. Y.
W. S. Barstow, Brooklyn, N. Y.
Jas. A. C. Bates, New York.
W. Worth Bean, St. Joseph, Mich.
John I. Beggs, the Cincinnati Edison Electric Company, Cincinnati, O.
Jas. L. Belate, Norfolk, Va.
Howard D. Black, Montreal.
Geo. A. Blaisdell, Woburn Electric Light, Woburn, Mass.
Jas. G. Biddle, Philadelphia, Pa.
Geo. G. Blakeslee, Naugatuck Electric Light Company, Naugatuck, Conn.
B. H Blodd, Washington Carbon Company, Pittsburg.
John P. Bonney, Baechtold & Parker Electrical Company, Brooklyn, N. Y.
Arthur L. Bosley, Frederick, Md.
H. Bottomley, Marlborough Electric Company, Marlborough, Mass.
A. Bournonville, Alfred Moore, Philadelphia.
Prof. Henry T. Bovey, Montreal, Canada.
J. M. Bradley, Superintendent Consolidated Electric Company, Birmingham, Ala.
T. H. Brady, New Britain, Conn.
H. H. Briggs, stenographer, New York City.
W. R. Brixey, New York City.
Capt. Wm. Brophy, Boston, Mass.
Victor Browning, National Carbon Company, Cleveland, O.
Wm. H. Browne the Royal Electric Company, Montreal, Can.
J. J. Bubert, Boston, Mass.
C. Carroll Burleigh, Camden, N. J.
J. J. Burleigh, Camden, N. J.
Chas. F. Burns, Rochester, N. Y.
J. A. Cabot, Chief Electrician Board of Administration, Cincinnati, O.
S. T Carnes, Memphis Light & Power Company, Memphis, Tenn.
W. W. Chamberlain, Norfolk, Va.
N. Willis Chambers, New York, N. Y.
E. A. Chapel, Chelsea Gas Light Company, Chelsea, Mass.
Chas. E. Chapin, Chapin-Douglass Electric Company, New York.
Arthur E. Childs, Electric Storage Battery Company, Boston, Mass.
H. F. Coggshall, Fitchburg Gas & Electric Light Company, Fitchburg, Mass.
W. Forman Collins, *Western Electrician*, Chicago.
W. A. Connor, Standard Underground Cable Company, Pittsburg, Pa.
C. M. Corpening, United Gas Improvement Company, Elec. Dept., Philadelphia.
W. H. Coughlin, Worcester Electric Light Company, Worcester, Mass.
W. H. Corrin, Oil City, Pa.
Thos. J. Creaghead, the Creaghead Engineering Company, Cincinnati, O.
J. S Crider, Washington Carbon Company, Pittsburg, Pa.
F. B. Crocker, New York City.
T. E. Crossman, stenographer, Brooklyn, N. Y.
J. B. Crouse, The Crouse-Tremaine Carbon Co., Fostoria, O.
J. Couilliard, Boston, Mass.
J. T. Cowling, Powelton Electric Company, Philadelphia, Pa.
Sam D. Cushing, Binghamton General Electric Company, Binghamton, N. Y.
B. W. Cutler, Boston Electric Light Company, Boston, Mass.
F. W. Darlington, Philadelphia.
Geo. W. Davenport, Street Railway and Illuminating Properties, Boston, Mass.
D. L. Davis, Electric Light & Power Company, Salem, O.
A. J. DeCamp, Philadelphia.
Mrs. A. J. DeCamp, Philadelphia.
L. A. Derby, Lowell Electric Light Company, Lowell, Mass.
Jas. R. Dee, Houghton, Mich.
L. A. Dodsworth, Charlotte Machine Company, Charlotte, N. C.
Alex. Dow. Engineer Public Lighting, Detroit, Mich.
D. W. Dunn, Collyer Insulated Wire Company, Pawtucket, R. I.
Paul A. Draper, Washington, D. C.
H. F. Edgar, Georgia Electric Light Company, Atlanta, Ga.
J. W. Ellard, Edison Electric Engineering Company, Baltimore, Md.
H. H. Fairbanks, Worcester Electric Light Company, Worcester, Mass.
C. E. Fargo, Canajoharie, N. Y.
Jas. Ferguson, Brooklyn, N. Y.
Mrs. Jas. Ferguson, Brooklyn, N. Y.
A. W. Field, Columbus, O.
J. H. Findlay, Ogdensburg, N. Y.
Fred Fish, the J. E. Putnam Company, Rochester. N. Y.
J. W. Fisher, Massilon, O.
Geo. Fobres, Olean Light & Power Company, Olean, N. Y.
Jas. B. Foote, Jackson Light & Power Co., Jackson, Mich.
M. J. Francisco, Rutland, Vt.
Mrs. M. J. Francisco, Rutland, Vt.
J. H. Francisco, Rutland, Vt.
H. W. Frund, General Manager Vincennes Electric Light & Power Company, Vincennes, Ind.
Geo. W. Furbed, Chicago.
J. Arthur Gage, Lowell, Mass.
H. F. Galpin, Chicago, Ill.
John L. Gans, *Electricity*, New York.
W. R. Gardner, Pittsfield Electric Company, Pittsfield, Mass.
F. F. Gardner, Newark Electric Light & Power Company, Newark, N. Y.
A. C. Garrison, Columbia Incandescent Lamp Company, St. Louis.
F. A. Gilbert, Boston Electric Light Company, Boston, Mass.
W. H. Girvira, Electric Light & Power Company, Syracuse, N. Y.
Robert J. M. Gommel, Allegheny Light Company, Pittsburg, Pa.
H. J. Gorke, Electrical Engineering & Supply Company, Syracuse, N. Y.
H. C. Gray, Consolidated Electric Company, Greenwich, N. Y.
J. C. Hadley, Pana, Ill.
Thos. W. Haldeman, Pottsville Edison Company, Pottsville, Pa.
Geo. Hall, Ogdensburg, N. Y.
C. S. Halsy, General Electric Company, Boston.
L. E. Hanson, Woburn Electric Light, Woburn, Mass.
Wm. J. Hammer, New York.
H. McL. Harding, Walker Company, New York.
Gerald W. Hart, Hartford, Conn.
F. W. Harrington, India Rubber & Gutta Percha Insulating Company, New York.
F. M. Hawkins, Electrical Engineering & Supply Company, Syracuse, N. Y.
M. M. Hayden, National Carbon Company, Cleveland, O.
Mrs. M. M. Hayden, Cleveland, O.
Ernest H. Heinrichs, Westinghouse Electrical & Manufacturing Company, Pittsburg.
F. Henderson, C. E. Ry. L. & P. Co., Charlotte, N. C.
W S. Hill, Boston, Mass.
Fredk. T. G. Hill, Waltham, Mass.
E. Chauncey Hillyer, Jr., Easton, Pa.
Geo. M. Hoag, City Electrician, Cleveland, O.
Geo. W. G. Holman, Cheltenham, E. L. H. & P. Company, Philadelphia, Pa.
Welles E. Holmes, Newton & Watertown Gas Light Company, Newton, Mass.
B. St. John Hoyt, Terre Haute Electric Railway Company, Terre Haute, Ind.
Chas. B. Hunt, London, Ont., Canada.
Henry G. Issertel, H. W. Johns Manufacturing Company, New York City, N. Y.
John J. Jennings, Wilkinsburg, Pa.
A. J. Jones, New Brunswick, N. J.
A. H. Jones, Philadelphia, Pa.
S. K. Johns, Cleveland, O.
Samuel C. D. Johns, Cleveland Electric Illuminating Company, Cleveland, O.
A. W. Johnston, Cincinnati, O.
W. J. Johnston, The Electrical World, New York.
Lessing Karger, Houghton, Mich.
Edwin S. Keefer, Western Electric Company, New York.
E. W. Kellogg, Frank Ridlon Company, Boston, Mass.
Jas. Kennedy, Washington, D. C.
E. B. Kittle, Interior Conduit & Insulation Company, New York.
F. K. Knowlton, Rochester, N. Y.
J. N. V. Lain, Electrician, Bangor, Me.
Geo. B. Lander, Concord, N. H.
F. M. Laughlin, Solar Carbon Manufacturing Company, Pittsburg, Pa.
A. B. Laurence, Shultz Belting Company, New York.
Waldo A. Learned, Newton & Watertown Gas Light Company, Newton, Mass.
E. A. Leslie, New York.
S. B. Libby, Haverhill, Mass
Thos. D. Lockwood, Boston.
C. W. Lyon, Manufacturers Electric Company, Philadelphia.

Robb Mackie, Manhattan General Construction Company, New York.
F. A. Magee, New York, N. Y.
H. Jules Mailloux, *The Car*, Philadelphia, Pa.
A. H. Manwaring, Philadelphia.
Mrs. A. H. Manwaring, Philadelphia.
A. Markle, Edison Electrical Illuminating Company, Hazleton, Pa.
T. C. Martin, *The Electrical Engineer*, New York.
John A. Mason, New York.
J. H. Mason, Simplex Electrical Company, Boston, Mass.
L. T. Mason, American Illuminating Company, Hornellsville, N. Y.
H. J. McCartney, American Telephone & Telegraph Company, New York.
C. H. McIntire, Newark, N. J.
John McLeer, Philadelphia, Pa.
Thos. R. Mercein, Secretary Northwestern Electrical Association, Milwaukee.
Benj. F. Miles, the National Carbon Company, Cleveland, O.
Herman Minkwitz, Meriden, Conn.
Geo. W. Moses, Chelsea Gas Light Company, Chelsea, Mass.
A. H. Mustard, Washington Carbon Company, Pittsburg, Pa.
Edw. L. Nichols, Cornell University, Ithaca, N. Y.
Jno. S. Nowotny, the Nowotny Electrical Company, Cincinnati, O.
Dudley Page, Frederick, Md.
A. B. Paulson, Philadelphia, Pa.
Ralph W. Payne, New York City.
A. H. Pease, Hartford, Conn.
E. F. Peck, New York City.
W. G. Peck, Chelsea Gas Light Company, Chelsea, Mass.
J. W. Perry, H. W. Johns Manufacturing Company, Philadelphia.
Eugene F. Phillips, Providence, R. I.
Frank N. Phillips, Providence, R. I.
O. D. Pierce, Philadelphia, Pa.
W. E. Pierce, City Electrician, Bangor, Me.
Edwin S. Pillsbury, Edison Electric Manufacturing Company, St. Louis, Mo.
C. M. Platt, Waterbury Traction Company, Waterbury, Conn.
W. L. Pratt, Adams, N. Y.
Chas. R. Price, New Bedford, Mass.
Chas. W. Price, *Electrical Review*, New York.
W. L. Proctor, Ogdensburg, N. Y.
C. J. Purdy, Electric St. & R. R. Company, Canandaigua, N. Y.
J. E. Putnam, Rochester, N. Y.
James E. Pyle, Edison Station, West Chester, Pa.
C. J. Reilly, Chicago City Railway Company, Chicago.
F. R. Redpath, Montreal, Canada.
Geo. A. Redman, Rochester, N. Y.
C. R. Remington, American Electrical Works, Providence, R. I.
J. H. Rhotehamel, Columbia Incandescent Lamp Company, St. Louis.
J. O. Richardson, Philadelphia.
Lincoln S. Rielly, Central Railway & Electric Company, New Britain, Conn.
C. T. Rittenhouse, THE ELECTRICAL WORLD, New York.
Wm. A. Rosenbaum, New York.
Robert A. Ross, Montreal.
Fred. W. Royce, Washington, D. C.
Chas. J. Russell, Manufacturers Electric Company, Philadelphia.
Geo. L. Sadler, Nashua, N. H.
Geo. W. Sadler, leather belting, Robin, Sadler & Haworth, Montreal, Canada.
Fred D. Sampson, Charlotte Electric Railway, Street & Power Company, Charlotte, N. C.
A. B. Sauerman, Standard Underground Cable Company, New York
Fredk A. Schiffler, the Sterling Company, New York.
D. T. Scott, New York.
Chas. E. Scott, Bristol E. L. & P. Company, Bristol, Pa.
Chas. F. Scott, Westinghouse Electric & Manufacturing Company, Pittsburg, Pa.
J. F. Seaman, United Light Company, Uniontown, Pa.
H. M. Shaw, Partridge Carbon Company & Eureka Tempered Copper Company, New York.
W. A. Sheldon, Bryan, O.
A. O. Shepardson, Central Railway & Electric Company, New Britain, Conn.
G. A. Shonmaker, Bristol Electric Light & Power Company, Bristol, Pa.
F. R. Shryock, People's Incandescent Light Company, Meadville, Pa.
J. A. J. Shultz, Shultz Belting Company, St. Louis, Mo.
H. J. Smith, Edison Electric Illuminating Company, New York.
F. Ellwood Smith, Somerville Electric Light Company, Somerville, Mass.
H. C. Spaulding, Manhattan General Construction Company, Boston.
E. J. Spencer, Safety Insulated Wire & Cable Company, St. Louis, Mo.
J. S. Speer, Partridge Carbon Co., Sandusky, O.
Henry D. Stanley, W. R. Brixey, New York.
George R. Stetson, New Bedford, Mass.
E. H. Stevens, Suburban Electrical Company, Elizabeth, N. J.
Luther Stieringer, Chicago Edison Company, New York.
Irving J. Sturgis, Houghton, Mich.
Edw. Sullivan, Standard Underground Cable Company, New York.
H. M. Swetland, *Power*, New York.
F. Taft, Brattleport, Vt.
T. R. Taltavall, THE ELECTRICAL WORLD, New York.
Benj. J. Taylor, Bristol E. L. & P. Company, Bristol, Pa.
Adolph Theobald, Columbus, O.
A. A. Thomas, Washington, D. C.
C. L Tolles, Jewell Belting Company, Hartford, Conn.
Calvert Townley, Westinghouse Electric & Manufacturing Company, Boston, Mass.
H. A. Tremaine, Fostoria, O.
Donald F. Urquhart, Thomson-Houston Carbon Company, Fremont, O.
W. A. Vail, A. T. & T. Company, New York.
C. R. Van Trump, Wilmington, Del.
Wm. Mayo Venable, the Nowotny Electrical Company, Cincinnati, O.
P. B. Verity, Shawnee, O.
E. E. Wade, El Paso Electric Company, Colorado Springs, Col.
John C. Waters, Mt. Morris Company, Mt. Morris, N. Y.
H. E. Webb, Solar Carbon & Mfg. Company, Pittsburg, Pa.
Walter Wentworth, Buffalo, N. Y.
A. W. Wes, General Electric Company, Boston.
Benj. R. Western, New York City.
Jos. Wetzler, *The Electrical Engineer*, New York.
Paul Whitehead, New York City.
G. L. Wiley, Standard Underground Cable Company, New York.
E. Ward Wilkins, Partrick & Carter Company, Philadelphia.
E. S. Wilkinson, Kensington Electric Company, Philadelphia, Pa.
S. B. Winchester, Holyoke, Mass.
C. H. J. Woodbury, American Bell Telephone Company, Boston, Mass.
Philip B. Woodworth, Lansing, Mich.
A. M. Young, Waterbury Traction Company, Waterbury, Conn.
R. E. Wyant, Derby Gas Company, Derby, Conn.

Gun Firing at the Exposition.

We have received from W. H. Baker, vice-president of the Postal Telegraph Cable Company, a copy of a letter received by that company from the National Exposition Company regarding the successful results in the use of the Postal Company's wires on the occasion of the opening of the Exposition last Monday night. It will be remembered that a circuit was made up, embracing the cities of San Francisco, St. Paul, New Orleans, Augusta, Me. and New York, and at each place a gun was fired by the current that was freed by Governor Morton to speed with lightning rapidity over the long circuit. This current, it will also be remembered, was generated at Niagara Falls, and thus, for the first time in history, the power of this wonderful work of Nature was felt over the whole length and breadth of the country. The letter is as follows :

Postal Telegraph-Cable Company, New York.

GENTLEMEN:—In behalf of the management of the National Electrical Exposition Company, I beg to thank you for your courtesy and valuable aid in connection with the arrangement for firing guns simultaneously at San Francisco, St. Paul, New Orleans and Augusta, Me., announcing the opening of the Exposition at the Grand Central Palace, New York, on Monday evening, May 4, 1896.

The circuit, which was composed throughout of the copper wires belonging to your company, was the longest circuit ever established for the purpose of firing cannon simultaneously at widely separated points, and the use of current derived from the power plant at Niagara to energize that part of the circuit between Buffalo and New York was the first time that such current was used for telegraphic purposes.

Immediately after Gov. Morton had closed the circuit (by means of the gold telegraph key which had been previously used only to start the machinery at the World's Fair at Chicago), messages were received from all the above-named cities, announcing that the guns had been fired electrically by his closing of the circuit, and without other human intervention, and telegrams of congratulation to the Governor from the mayors of the points named, followed within a remarkably brief space of time.

Your company is to be congratulated not only upon the possession of wire facilities which enabled you to accomplish this remarkable feat of long-distance telegraphy, but also upon the thorough organization and hearty co-operation of your employees throughout the country, without which it could not have been successfully accomplished.

Thanking you again for your courtesy and aid, we are,

Yours truly,

(Signed) C. H. WILMERDING,
President National Electric Light Association.

(Signed) HARRISON J. SMITH,
President Exposition Company.

(Signed) GEO. F. PORTER,
Secretary.

(Signed) F. W. HAWLEY,
Chairman, Reception Committee.

Convention Notes.

Mr. Fred W. Royce, of Washington, D. C., and his handsome son, Master Fred D. Royce, were conspicuous for their popularity.

Mr. J. F. Blauvelt, of the New England Butt Company, Providence, arrived a little late, but everybody was glad to see him.

The American Electrical Works was creditably represented by Messrs. P. C. Ackerman and C. R. Remington, both of whom everybody knows.

Capt. Brophy, now Deputy Commissioner of Wires for Boston, was in as much demand as ever, and as usual there were abundant evidences of the hold he has upon the hearts of everybody in the electrical business.

Hon. T. W. Flood, Commissioner of Wires for Boston, was a visitor. He was the recipient of many kindly courtesies, and is quite sure to carry back with him many pleasant remembrances of the personnel of the electrical business.

Mr. W. S. Hill, Boston, the veteran, was the recipient of many sincere congratulations, and President Stetson, of the newly organized W. S. Hill Electric Company, was evidently gratified at the numerous manifestations of Mr. Hill's popularity.

The Simplex Interior Telephone Company, of Cincinnati, has received many compliments on the admirable working of its hotel system which is installed at the Electrical Exposition and which is operated in connection with a Partrick & Carter annunciator.

Messrs. A. H. Pease and G. W. Hart, of the Hart & Hegeman Manufacturing Company, Hartford, Conn., through their presence, accomplished just as much as if there had been an exhibit of the well-known manufactures of their company. Everybody knew them and they knew everybody.

Mr. J. Holt Gates, "Gates of Chicago," was present at the convention, and it is understood has made arrangements to take the Western agency of the well known C. &. C. apparatus. Few men have a wider acquaintance in the West, and under his energetic direction the Western business of the C. & C. Electric Company will be sure to grow and prosper.

Mr. W. C. Balda, of the Utica Electrical Manufacturing & Supply Company, Utica, N. Y., devoted his time during the convention to energetically discussing the merits of the lightning arresters, switches, cut-outs and other well-known specialties of his company. As a result he will return to Utica with some nice orders, and the best of it is he will deserve them.

The Falls Rivet & Machine Company, Cuyahoga Falls, O., while it did not have an exhibit, had as its representative at the convention Mr. E. L. Babcock, to meet his old friends and the friends and customers of the company among the electric light men. The Falls Rivet & Machine Company has done and is doing an extensive business with lighting and power companies.

Mr. Eugene F. Phillips was very much in evidence. His strong popularity always overrides his modesty, and for "'Gene" Phillips to be in the background is an utter impossibility. He was accompanied this time by his son, Frank N. Phillips, who will soon graduate from the Institute of Technology, and who bids fair to make for himself honor, name and fame, like his good father.

The Hill Electric Company, New Bedford, Mass., was represented at the convention by Messrs. Hill, Mendell and Stetson. From the good impression made by these gentlemen during the meeting, and from the energetic work each has done in the past, it is evident that the triumvirate will soon place the Hill Company among the foremost electrical supply manufacturing houses of New England.

Mr. "Jim" Wolff, who has charge of the Chicago branch of the New York Insulated Wire Company, was one of the most popular men at the convention. All who met him will carry away pleasant recollections of their visit to New York. Mr. Wolff and his compatriots from the Windy City made their presence known by the cry of C-h-i-c-a-g-o—Chicago! given with a will in true college fashion.

Mr. A. Snow, Jr., of the Pairpoint Manufacturing Company, New Bedford, Mass., with which the Mt. Washington Glass Company has been consolidated, reached New York a little late for the convention, but spent several days in the city, and, of course, was much interested in the different exhibits. Mr. Snow's company is doing a large business with electrical companies, and is preparing to do more.

Mr. J. E. Ham, New York agent for Mr. W. R. Brixey, the "Kerite" wire manufacturer, divided his time about equally between his office, the Murray Hill Hotel and the Exhibition. It was always business with him. At the same time his social side was made manifest, for he had a word of cheery greeting for every one he met, and there are few in the business with whom Mr. Ham is not acquainted.

The Simplex Electrical Company, of Boston, was represented at the convention by its general manager, Mr. J. H. Mason, one of the most estimable if one of the most modest men in attendance. Simplex wire has long been a favorite with some of the leading lighting and power companies, and by reason of its high quality cannot fail to continue so.

Mr. J. Y. Hamby, of the Beacon Incandescent Lamp Company, Boston, attended the convention, and it is needless to say that in his hands the interests of the company were well taken care of. The Beacon lamp is still a prime favorite with many of those who were present at the meeting, and who hope that the prospects of the company will continue to be as bright as the lamp it manufactures.

The Elliptical Carbon Company, Chicago, was well represented at the convention by its general manager, Mr. Chas. E. Gregory. This company, although comparatively a newcomer in the field, has already done excellent work, and gives promise of much future usefulness. Mr. Gregory is personally one of the best known and most popular of the many estimable hustlers for which we have to thank the Windy City of the lake.

Mr. R. E. Lucas, of the Indiana Rubber & Insulated Wire Company, Jonesboro, Ind., attended the convention, and it is safe to say that "Paranite" wire lost nothing of its popularity by his presence. Mr. Lucas is one of the most genial men in the trade, and the merits of his wire are rapidly becoming as well-known in the East as they long have been in the West. The result is that he will take some nice orders back home with him.

"Baird, I saw an Eddy motor in one of our police stations the other day," said W. H. Coughlin, superintendent of the Worcester Electric Light Company. And everybody in the group roared. Singular experience for an electric motor, but it was gratifying to have explained that the motor had not been "run in" for misconduct, but instead had been selected on account of its many good qualities, and proved a "credit to the force."

Mr. E. G. Bernard, of the E. G. Bernard Company, Troy, N. Y., was at the convention, where his genial presence assisted materially in increasing the already well-known reputation of the apparatus which his company manufactures. Mr. Bernard has succeeded in building up in a few years a business of which he may well feel proud. He has demonstrated that a well-designed machine, carefully made and sold at a reasonable price, will meet with a generous sale.

Mr. J. S. Crider, of the Washington Carbon Company, Pittsburg, Pa., was one of the best known attendants at the convention, where his personal popularity and convincing arguments resulted in considerably increasing the number of orders which his company has taken this year. There is probably no better known carbon company than the Washington, and none which has done more, not only to maintain but to improve the grade and quality of its output.

Mr. Charles W. Bassett, of the insulated wire department of the Washburn & Moen Manufacturing Company, and Mr. H. G. Stoddart, his assistant, were present at the handsome exhibit of this company. These two gentlemen are recognized as a strong combination, and it was fitting that they should have been identified with the opening ceremonies. Mr. Bassett has already won many laurels in the "business race," and Mr. Stoddart is his "running mate." They travel together evenly and nicely and are "good winners."

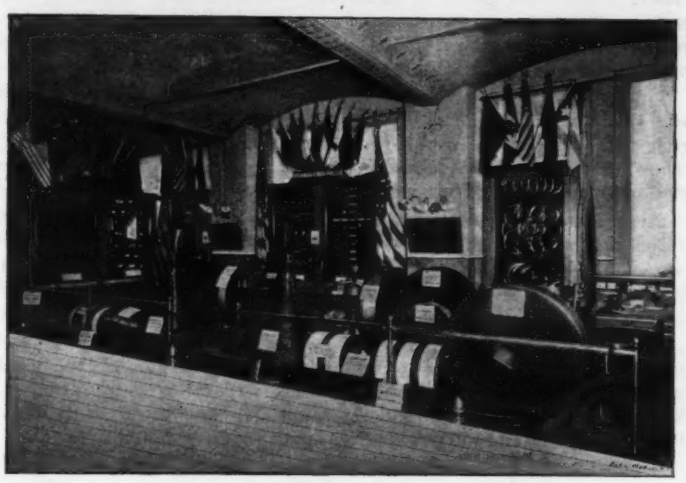
Mr. W. R. Brixey entertained his numerous friends at the Murray Hill in the princely fashion for which he is noted. Instances were very rare when he could not be seen in the centre of a group. Mr. Brixey earlier in his successful career was mate of a sailing ship and had gone around the world several times Mr. A. G. Day, the inventor and first manufacturer of "Kerite," was Mr. Brixey's brother-in-law. Under Mr. Brixey's management the sale of "Kerite" has far exceeded anything that Mr. Day in his lifetime would probably have thought possible.

The American District Steam Company, Lockport, N. Y., while it had no regular exhibit, was efficiently represented by its treasurer, Mr. I. H. Babcock. Mr. Babcock has made a thorough study of heating by exhaust steam, and it is hoped that at a future meeting he may favor the members of the National Electric Light Association with a paper, or even a talk, on the important subject of how lighting and power stations may utilize to advantage their exhaust steam. Mr. Hall, another of the office staff of the American District Steam Company, was also present at the convention.

Some of the Exhibits.

MR. JOHN UNDERHILL, New York representative of the Corliss Steam Engine Company, Providence, R. I., is at the Exposition and making many friends.

THE WASHBURN & MOEN MANUFACTURING COMPANY has a very attractive exhibit, comprising samples of the wire it produces, and also large reels of some of its more special productions. Among these is a special trolley-wire of a pear-shaped section, arranged so that the clamps do not interfere with the continuity. Magnet-wire guaranteed to be less than one two-thousandths of an inch variation in diameter is shown, and a



THE WASHBURN & MOEN EXHIBIT.

complete line of crown rubber insulated wire for inside work. A special feature is two coils of wire, one .0029 of an inch in diameter and the other .0025—finer than the average human hair. A piece of the famous cable for the Carnegie building is exhibited. This cable is 2,790,160 circ. mils in area. Samples of lead-covered cable are also shown, as well as of the Chicago copper rail-bond. The company is represented by Messrs. Charles W. Bassett, H. G. Stoddard, H. C. Willis and Mr. Fitzgerald.

Mr. S. P. CONDIT, of the L. A. Chase Company, Boston, was here, there and everywhere. He could not even on this occasion suppress his hustling and effervescent qualities.

CASSIER'S MAGAZINE is represented by Messrs. A. D. Chandler and H. L. Aldrich. Mr. Cassier has recently returned from England, and is at the hall making many friends.

THE VACUUM OIL COMPANY, Rochester, N. Y., is showing a nice line of cylinder and engine oils; also dynamo and motor oils. The company is represented by Mr. E. A. Record, of Boston.

THE AMERICAN CARBON COMPANY showed a full line of electric-light carbons, carbon cylinders, battery carbons and carbon brushes. The exhibit is in Section J, and makes a good show.

A. K. WARREN & CO., New York, have a booth for the purpose of advertising the fact that they do repair electrical work. The company will undertake anything in the line of electrical repairing.

MR. JOHN GORMAN, of St. Paul, Minn., late superintendent of construction for the Edison Company at that city, is a visitor at the convention. Mr. Gorman claims to be the only representative from St. Paul.

THE AMERICAN CIRCULAR LOOM COMPANY, of Boston, kept open house at the Murray Hill, and hosts of old and new friends were welcomed by Messrs. A. T. Clark, H. H. Brooks, C. D. Doubleday and H. B. Kirtland.

MR. CHARLES A. WHITE, of Bibber, White & Co., Boston, was present, and was never too tired to talk of the "Crefeld" wire products, or to entertain his friends with his apparently inexhaustible fund of wit and humor.

MR. CHARLES E. BIBBER, Boston, was as usual, active in his movements, and, as New England representative of the Columbia Incandescent Lamp Company, was conspicuous at the handsome exhibit of that company.

THE WESTON ENGINE COMPANY, Painted Post, N. Y., exhibits a 90-hp engine in charge of Mr. John Harvey. The engine runs at 280 revolutions per minute and is entirely self-lubricating. It is belted to a Warren alternator.

THE NEW YORK INSULATED WIRE COMPANY, New York, entertained its numerous friends in a handsome manner at its quarters in the Murray Hill Hotel. Messrs. R. E. Gallaher, James F. Kelly and James Wolff did the honors.

THE SIEMENS & HALSKE ELECTRIC COMPANY, Chicago, represented by Mr. Charles D. Shain, exhibits a 100-kw six-pole generator having an external commutator. It is direct-connected to the engine forming the Ball & Wood exhibit.

CHARLES A. SCHIEREN & CO., New York, have on exhibition perforated belts from 72 to 54 inches. The company is well represented by Messrs. C. A. Schieren, Jr., D. S. Shaurman, Tom Thornton, E. B. Underhill and E. P. Atkinson.

MR. J. E. WOODBRIDGE has an interesting exhibit of the triple lock printing telegraph of his own design. This instrument is a page printer, requires no receiving operator, and will work quadruplex over 500 miles of wire at typewriter speed.

ADAMS COOK'S SONS, of New York, exhibit consists of Albany compound for lubricating purposes, Albany grease cups, compression and spindle cups. One of the features of the exhibit is a show case containing a line of grease and oils.

THE WATERTOWN STEAM ENGINE COMPANY, Watertown, N. Y., exhibits a 60-hp 10 x 12 engine, which was one of the first to turn over at the Exposition, and has since been carrying a very heavy overload. Mr. L. Copleston represents the company.

THE MASON REGULATOR COMPANY, of Boston, exhibits its steam specialties, which include its damper regulator, rheostat regulator and reducing valve. The company is represented by Mr. T. G. Oakes, New York agent, and his associate, Mr. O. M. Jones.

THE ASHTON VALVE COMPANY, Boston, Mass., makes a creditable display of its well-known pump valves, steam gauges, engine registers, marine clocks, etc., in charge of its New York agent, Mr. Charles H. Buckalow, assisted by Messrs. Thomas G. Oakes and O. M. Jones.

THE THOMPSON METER COMPANY, Brooklyn, N. Y., manufacturers of water meters, has a very fine display of meters from ⅝-inch to 4-inch; also an improved Lambert and an intermediate and straight-reading register. The company is represented by Mr. S. D. Higley.

MR. T. H. BRADY, New Britain, Conn., exhibits in the space of the Peck Electrical Company the various specialties with which his name has been long identified, and which do not require special mention. They included pole hoods, mast arms, cut-out boxes, sleet-proof pulleys, etc.

THE FOREST CITY ELECTRIC WORKS, Cleveland, O., presents an attractive exhibit, showing its various types of roll-drop and drop-forge street railway motor and dynamo segments. Mr. W. B. Cleveland was in attendance, and the exhibit is in charge of Mr. J. C. Dolph, Eastern agent.

MR. A. O. SCHOONMAKER of New York is exhibiting a fine line of mica specialties; mica in the rough and in the finished state. Mr. Schoonmaker makes a specialty of mica washers, and the latter are exhibited in all shapes, sizes and forms imaginable. The exhibit is well worth a visit.

THE INTERIOR CONDUIT & INSULATION COMPANY, New York, secured a large space for an exhibit in a prominent part of the hall, where it displays its numerous goods in a most attractive manner. Lundell dynamos and motors of various sizes form a prominent feature. Ceiling fans and small high-speed fans create a cool breeze around the exhibit. A most interesting motor to technical experts drives a cylinder press. This is of 2 horse-power and has a speed of only 175 revolutions per minute, which means an exceedingly large torque. The Lundell motor is shown adapted to the driving of dental engines, and there is an interesting dis-

EXHIBIT OF THE INTERIOR CONDUIT & INSULATION COMPANY.

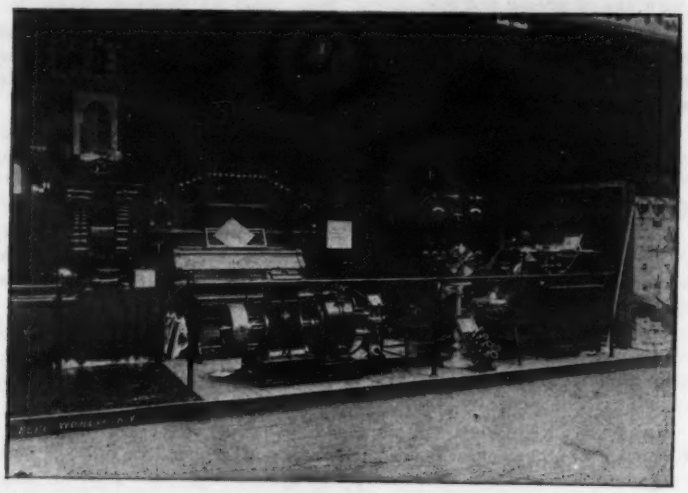
play of this apparatus. A full line of all kinds of interior conduits is shown, and a little generating set, composed of a Case engine, directly connected to a Lundell dynamo, has the appearance of being both compact and readily portable. The exhibit is surmounted by an enormous electric sign, which lights up the hall around for a considerable distance. There is also an organ, which is blown by a Lundell motor provided with special apparatus adapted for this service. The company is well represented by Messrs. B. C. Burland, George P. Kimbel and E. B. Kittle.

THE BIRDSALL MANUFACTURING COMPANY, New York, attracts much attention among lay visitors because of the very popular character of

its exhibit. All kinds of electric apparatus for advertising purposes, such as cigar lighters, flower beds, illuminated signs, etc., were exhibited.

The Payne Engine Company, Elmira, N. Y., is represented by Messrs. S. H. and N. B. Payne. The exhibit consists of a 35-hp engine, driving a 25-kw dynamo made by the Card Electric Company. Mr. R. T. Lozier, of the Card Electric Company, is in charge of the electrical part of the exhibit.

De Veau & Co., New York, were in a conspicuous position, and exhibited a line of telephone apparatus. All kinds of transmitters and



Lundell Motors.

receivers were shown, as well as open circuit batteries and switchboards for telephonic use. Mr. DeVeau was present looking after the interests of his firm.

The Ball & Wood Company, New York, exhibits a 150-hp engine, a feature of which is the new governor, which is said to work even better than the old dash-pot governor. A leaf spring is substituted for the spiral. Messrs. C. R. Vincent Hughes and H. E. Mead represent the company.

The J. H. McEwen Manufacturing Company, Ridgway, Pa., exhibits a 65-hp engine connected to a 40-kw Thompson-Ryan generator. The finish of these machines is very beautiful and their appearance striking, as their operation will also be. Messrs. J. H. McEwen and F. G. Bolles are in charge.

Mr. W. Goldstein in a handsomely decorated booth displays samples of his boiler compound and has a large showcase full of boiler scale. Mr. Ralph P. Boissett is in charge, and the large attendance around the booth demonstrates the interest taken in Mr. Goldstein's compound for removing scale from boilers.

Messrs. Eugene Munsell & Co., New York and Chicago, exhibit mica as obtained rough from the mine; also mica in a finished state. The exhibit interests electrical men, because of the adaptability of mica for electrical work, and also its cheapness. The firm is represented in the exhibition hall by Mr. Edward C. Wood.

The Pettingell-Andrews Company, Boston, was represented by Mr. C. B. Price, its general manager, who was present with his good wife. The company had no special exhibit, but its sign was conspicuous at the booths of the Okonite Company, Interior Conduit & Insulation Company and Standard Paint Company.

The Joseph Dixon Crucible Company's exhibit contains such of the products of the company's works as are interesting to electrical men. Graphite for resistance and other purposes constitutes the special character of the exhibit. One interesting feature is an especially large piece of native graphite from Ceylon.

The United States Prism Glass Globe Company, New York, is making a fine display of prism globes in various colors. These globes soften and diffuse the light, expand the flame and scatter the rays to the best advantage. The company is represented by G. A. Annable, who is kept busy describing the merits of the globes.

The Partridge Carbon Company, Sandusky, O., shows a line of its well-known self-lubricating generator and motor brushes, which is attracting much attention from those interested in this class of goods. The company is represented by Mr. J. S. Spier, secretary and treasurer, and Mr. Harry M. Shaw, the Eastern agent.

Messrs. Huebel & Manger, Brooklyn, exhibit a board showing electric gongs, push buttons, switches, etc. The board is encased in a glass case, and being in a conspicuous position makes a fine appearance. Messrs. Huebel, Manger and McChesney took turns in looking after the firm's interests, and made many new friends.

Messrs. J. F. Bubert and E. C. Lewis, both prominent in Boston in electrical engineering and construction lines; W. S. Barker, New England representative of the New York Insulated Wire Company, and F. B. Smith, Boston representative of the Perkins Electric Switch & Manufacturing Company, were an inseparable contingent.

Mr. A. K. Bonta, Hoboken, N. J., exhibits his specialties in a well-appointed booth on the third floor. His emergency brake, which is now under the control of the General Electric Company, is shown. Mr. Bonta also exhibits his safety stop for runaway engines, which he was induced to perfect by the recent accident at his power station.

The Diamond Electric Company, Peoria, Ill., exhibits a line of its transformers from 300 to 10 lights and also a Schaeffer recording wattmeter. The company distributed copies of reports of tests on the wattmeter and on the transformers. Mr. S. R. Sheldon was in charge, and explained the principles and merits of the apparatus.

The Tuerk Water Meter Company, Fulton, N. Y., has a nicely equipped booth, in which to exhibit its alternating and direct current fans. It shows five of the alternating and two of the direct. The Tuerk fans have a special attachment whereby they can be made to revolve if necessary without fanning the air.

The National Carbon Company's exhibit is in charge of Mr. M. M. Hayden, though Mr. B. F. Miles was also present during the convention. The company manufactures every style in electric light, battery, smelting and resistance carbons. It also makes telephone transmitters and carbon brushes. Altogether the display is a very creditable one.

The New York Safety Steam Power Company, New York, exhibits a 100-hp engine belted to a 65-kw Crocker-Wheeler dynamo. The power generated is used in the exhibit of the Crocker-Wheeler Company. Messrs. Tewksbury and Lufkin represent the New York Safety Steam Power Company and the Crocker-Wheeler Company, respectively.

Messrs. Dale, Farrell & Co., New York, are displaying several new specialties, including bicycle lamps, Volta primary battery, magneto call and test bells, etc. A sewing machine is being driven by the power from two cells of this battery, and an eight-inch, four-blade fan by one cell. They are represented by Messrs. J. Francis, G. A. Lutz and W. S. Doe.

Mineral wool, for building purposes, is exhibited by the U. S. Mineral Wool Company, New York City. This substance is a non-conductor of heat, cold, fire and sound, and it will not harbor vermin. It is extensively used in connection with electrical and street railway power houses. The exhibit is in the basement, and attracts much attention.

Curtis & Hall, Hartford, Conn., exhibit their automatic electric feed water purifier, the only electric device it is claimed that prevents the formation of scale in a steam boiler, and one that will remove all scale. Its first and most notable installation was in connection with the Brooklyn Bridge. Mr. George J. Wells, New York agent, is in charge of the exhibit.

The Henry R. Worthington Company, New York, exhibits a fine collection of electric power pumps. Duplex pumps, steam pumps and pumps with differential plungers were shown at work. The electric pumps are driven by Crocker-Wheeler motors and work smoothly and quietly. Messrs. Thomas Cummings and F. W. Jones are in charge of the exhibit.

The Metropolitan Telephone & Telegraph Company exhibits a model pay station designed to illustrate all the features of such an insti-

Metropolitan Telephone & Telegraph Company's Booth.

tution. It shows the different styles of sound-proof booths, including desk stand set, wall set and oak cabinet wall set and large oak cabinet. Also a switchboard with 40 drops, operated by a lady attendant. Exhibitors are all provided with desk stand sets with which they may talk with any point in New York City free of charge. The booth is in charge of Mr. M. E. Huntingdon.

THE BERNSTEIN ELECTRIC COMPANY, Boston, pioneers in the manufacture of series lamps, makes a very interesting display of its products and of its alternate-current series system. Lamps of every conceivable shape and quality, colored, frosted, spherical, bung-hole, and of every commercial voltage are shown. Messrs. H. B. Cram and James Bradley represent the Bernstein interests.

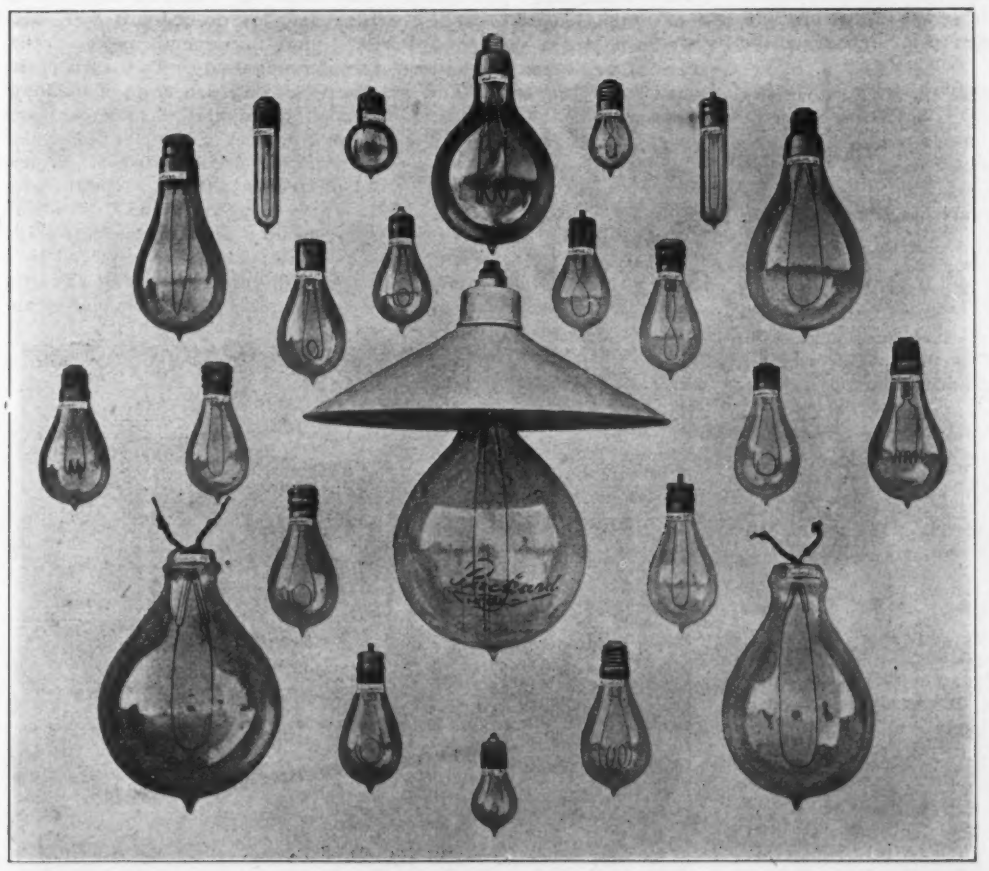
THE BALL-BEARING COMPANY, Boston, represented by Messrs. N. S. McGowan and J. A. Morton, exhibits bearings for machinery, and for mechanisms of every class. The frictionless quality of the bearings is evidenced at once when one handles the various parts and turns the journals upon the bearings. Steel balls of all sizes, even down to $\frac{1}{200}$ of an inch in diameter, are exhibited.

THE PARTRICK & CARTER COMPANY, Philadelphia, manufacturers of electrical household goods, had a very attractive exhibit of its products including many new specialties. Mr. Townsend, who has charge of this exhibit, states that he has done some excellent business in the Exhibition Hall. The company is also represented by Messrs. C. M. Wilkins, and E. Ward Wilkins.

THE EXCELSIOR ELECTRIC COMPANY, New York, displays a line of Churchward multipolar generators, together with the Hochausen arc system and a full line of arc motors. The Churchward rotary balance coil and equalizer system is exhibited. This system was subject to Mr. Churchward's paper read before the National Electric Light Convention. Mr. Churchward was in charge of the exhibit.

THE BALL ELECTRIC LIGHT COMPANY, New York City, has on exhibition a 100-light, 10-ampere automatic dynamo and a 70-light four-ampere automatic dynamo ; ornamental and plain series arc lamps. Literature descriptive of this exhibit is freely distributed by Mr. Wm. J. Morrison, the well-known veteran, who is in charge of this exhibit ; Messrs. Chas. E. Ball, J. S. Bell and J. C. Williamson are also in attendance.

THE NEW YORK & OHIO COMPANY, Warren, O., has an excellent display of its lamps in the booth of Stanley & Patterson. This booth is decorated and lighted by these lamps, and their arrangement very tasty and effective. Fifteen 16-cp 110-volt lamps run down each side-post, and along the ceiling, border are 24 lamps of 50 candle-power each. In the centre of the booth hanging from the ceiling, is a cluster of six 16-cp lamps, and at each corner is a



NEW YORK & OHIO COMPANY LAMPS.

32-cp Packard lamp enclosed in a stalactite globe. Back of the the cluster is a 500-cp Mogul lamp. These lamps are in different colors, and give a pretty effect. The accompanying illustration shows a bank of Packard lamps of all sizes and of different designs, which is situated at the centre of the booth. The current for the lamps that are disposed around the booth is generated by a Stanley & Patterson motor-generator, all the lamps being of 110 volts. There are also shown two Packard lamps that deserve special mention. One of them has been burning for 950 hours and the other 788 hours—both in the Carnegie Music Hall in New York. Both lamps are still in good condition.

MR. HUGO REISINGER, New York, who is sole importer of the Nuernberg "Electra" carbons, has a large space in which he exhibits his goods in a very attractive manner. The booth is finished in white and gold, and has ample accommodations for those who are interested in such goods as are

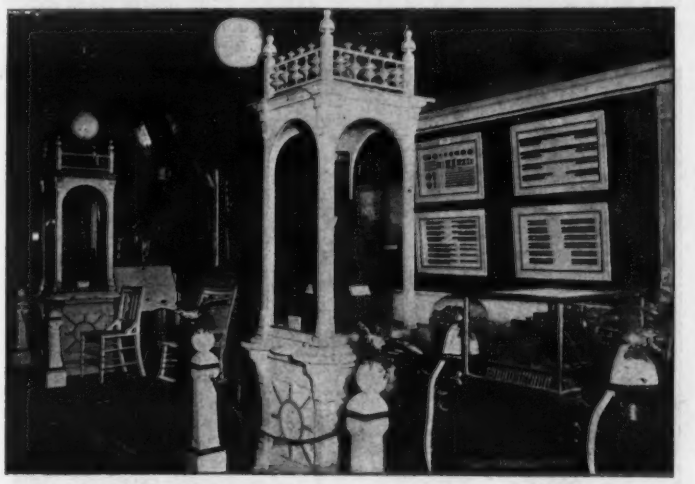
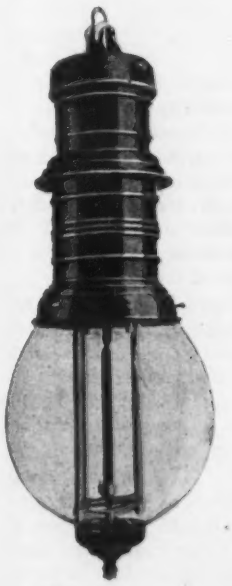


EXHIBIT OF HUGO REISINGER.

here presented. The Nuernberg "Electra" carbons, both for alternating and direct-current lamps, are stacked in neat piles for exhibition purposes and are also used to decorate the booth. Microphone carbons and a full line of battery carbons are also shown. Messrs. J. F. Outwater and Fred Nolker represent Mr. Reisinger.

JOHN A. ROEBLING'S SONS COMPANY, Trenton, N. J., has an attractive booth on the left hand side of the main floor in which it exhibits samples of every wire that it makes, including lead covered cables for telephone, telegraph and street railway work, submarine cables, trolley wires, feeder wires, house wires, annunciator, office, magnetic and rubber-covered wires, and also a paper insulated lead-covered cable.

THE HELIOS ELECTRIC COMPANY, Philadelphia, in one sense covered much of the hall with its exhibit. Its lamps were scattered among the various exhibits, being loaned by the Helios Company for illuminating purposes. The brilliancy of the light and its steadiness elicited much favorable comment.



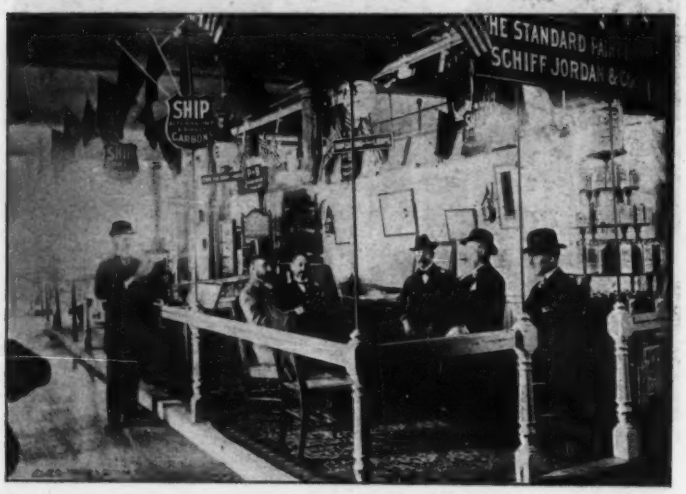
HELIOS LAMP.

THE AMERICAN ELECTRIC HEATING CORPORATION has an exhibit that attracts at least as much attention as any other in the hall. The company shows how the current can be adapted to cooking, laundry and other household purposes. The cooking department is presided over by Miss Emma C. Sickels, the cooking school teacher, and the company is represented by Messrs. Jas. I. Ayer, L. L. Parsons and R. S. Jerome.

AN IMMENSE piece of pure Para rubber, weighing 697½ pounds, was a principal feature of the exhibit of the Okonite Co. Sample pieces of

wire, covered with Okonite, attracted the attention of visitors. The booth of the company was very artistically arranged. Captain W. L. Candee, George T. Manson and Romaine Mace were in attendance, and welcomed their many callers with that cordiality for which they are celebrated.

The Standard Paint Company, represented by F. F. Vandewater, Frank S. De Ronde and J. N. Richards, exhibits a full line of its products, consisting of the well-known P. & B. paint, ruberoid insulation, tapes



Standard Paint Company Exhibit.

and motor curtains. As agents for Schiff, Jordan & Co.'s "Ship" carbons the company has also a fine display of these goods.

Pass & Seymour, of Syracuse, N. Y., exhibit a line of china tubes for insulating purposes. There are 287 sizes in the exhibit. One of the new features of the exhibit is a china socket which is intended to do away with metallic shells and caps. The firm also shows a new china socket for use in the Edison system, which does not infringe the Edison patent. The screw thread is on the china. Mr. J. D. McIntyre is in charge of the exhibit.

The Keuffel & Esser Company, New York, exhibits a full assortment of accessories used by electrical engineers in field and office practice, such as Paragon drawing instruments, scales, drawing tables and blue print frames. Also the latest improved styles of transits and leveling instruments, steel tapes, planimeters, reckoning machines, slide rules and leveling rods, and poles. The company is represented by Mr. J. A. Schildecker.

The Peru Electric Manufacturing Company, Peru, Ind., has a very attractive exhibit on the north side of the hall. The firm is represented by Messrs. Bouslog, Schutte and Stevens. The line of goods exhibited consists of porcelain cut-outs and insulators for electric light wiring, and the Laclede-Hercules open-circuit battery. The exhibit is tastefully arranged, and shows off to good advantage among its more spectacular neighbors.

The India Rubber & Gutta Percha Insulating Company exhibits wires of its various brands of red, white and blue core, including the well-known Habirshaw wire, and also lead-covered cables. Messrs. J. W. Godfrey, F. W. Harrington and J. B. Olson are active in making the display attractive to visitors and explaining the merits of the goods. Mr. W. M. Habirshaw, the inventor, and president of the company, was also present part of the time.

The Pennsylvania Slate Company, represented by Mr. G. W. Bower, has an attractive booth in which are displayed samples of slate in all processes and grades of marbleization. So beautifully is this work done that it is difficult to distinguish the result from genuine marble, of which any grade and quality can be imitated. This slate has been used by some of the foremost electrical companies and is preferred because of its freedom from metal veins.

The Fuel Economizer Company, Matteawan, N. Y., exhibits some of its tubes, headers, plugs, scrapers and various tools, and also a large line of blue prints and plans which are quite complete. Messrs. W. Downs and W. E. Cryer explain the methods of the company to all interested visitors, and the number of those who ask for information shows the increasing attention that electrical companies are paying to the very practical subject of fuel economy.

The Lakon Company, Elkhart, Ind., exhibits transformers from 10 to 125 lights in size. The new ceiling fan brought out by this company for alternating-current is also attracting much attention. This fan is of the inductor type, and is ball-bearing throughout, having an ingenious reducing motion to gear down the motor speed. Messrs. E. B. Latham & Co., New York, represent the interests of the company in this locality, while Mr. C. A. Parcell is in charge of the exhibit.

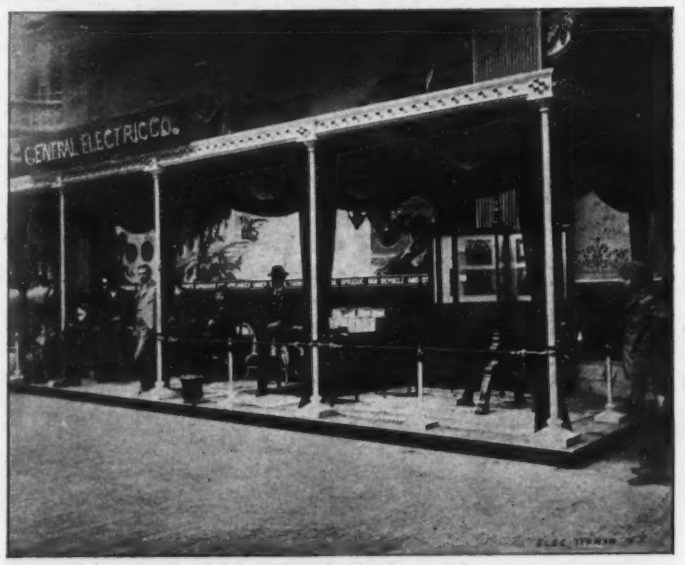
Stanley & Patterson, New York, have a fine display of Packard lamps and general construction material. A little motor generator supplied by the E. G. Bernard Company, Troy, N. Y., runs so quietly in one corner of this exhibit that unless the visitor is careful he will find himself leaning against it and endangering his clothing. It appears to be practically at rest as far as noise and vibration is concerned. Messrs. A. F. Stanley, G. L. Patterson and H. Mays are officiating.

The S. K. C. Company of Pittsfield, Mass., illustrates its two-phase system with a 160-kw two-phase inductor dynamo, a 60-kw transformer, stepping down from 5000 to 2000 or 1000 volts; several S.-K. condensers, which always figure as unique features of the company's installations, were also shown. A number of ingenious high-tension switches with a special device for cutting off the arc formed an attractive feature of the exhibit. Mr. Theo. Theberath represents the company.

H. B. Coho & Co., New York, have two of its Eddy generators, 40 and 30 kw respectively, directly-connected, one to a Watertown and the other to an Ideal engine. The 30-kw connected to the Watertown engine was the first to give power to the exhibits and has carried an extremely heavy overload ever since. H. B. Coho & Co. also exhibit Crown woven wire brushes and a handsome switchboard. Carbons brushes are run on one machine and wire gauze on the other to show that either is adaptable.

The General Incandescent Arc Light Company, New York, has a most attractive and complete exhibit of its goods. A chandelier of arc lights forms a principal feature, and owing to its tremendous lighting powers, is well adapted for large auditoriums. The company has the agency for the Schmeltzer Nuernberg carbons, of which it has a fine display. A well-appointed switchboard controls the live powers of the exhibit, and Mr. R. B. Corey in attendance made all visitors welcome.

The General Electric Company's exhibit at the Exposition is rather a pervading presence than a specific exhibit of its manufactures. The space occupied by the company is enclosed by a pillared cornice studded on the outside with a line of special 6-cp miniature yellow lamps, broken at the top of each pillar by a group of four violet lamps of the same candle power, and on the inside with 240-volt 16-cp frosted lamps. Above the space against the wall is a large monogram, with the initials of the company set in different colored miniature lamps. The right of the space is occupied by a stand supporting a number of swivelled frames containing photographs of some of the important work done by the General Electric Company, such as the 96-ton B. & O. electric locomotives, the great Portland and Sacramento power transmissions, and other installations of similar magnitude. To the left of the space stands an ornamental standard carrying arc lamps of the long-burning, constant-potential, direct and alternating incandescent and power-circuit types. On the tables are a number of samples of the new line of measuring instruments for alternating circuits, some of the new alternating-current fan motors, and two samples of the new type H transformers. The space is inclosed with a unique railing formed of railway feeder cable supported by insulated suspension and turnbuckles. The miniature lamp department has an exhibit of its own, placed in a small room left of the main space. The principal feature of this is a display board, on which is mounted a sample of every kind of incan-



General Electric Booth.

descent lamp outside the miniature category manufactured by the company. On a stand in the centre of the room are two boards, one carrying a variety of samples of candelabra miniature and decorative lamps, the other samples of battery lamps. The company was represented by Messrs. S. D. Greene, J. R. Lovejoy, W. L. R. Emmet, J. Kirkland, H. C. Wirt, W. Felton, J. M. Andrews, of the Schenectady office; Messrs. Chas.

T. Hughes, T. Beran, C. Gundaker, C. G. Davenport, George D. B. Greene and others from the New York office; Messrs. C. B. Davis, F. M. Kimball, Haley, Ives and Bush, of the Boston office; H. J. Buddy, of the Philadelphia office; W. F. Hays, of the Cincinnati office; A. E. Giles, of the Atlanta office, and Messrs. A. D. Page, M. K. Eyre and McAllister, of the lamp works at Harrison.

THE KENNEDY VALVE MANUFACTURING COMPANY, New York, shows a nice line of its standard goods, consisting of high-pressure valves from 20-inch down, with by-pass which stand 250 pounds to the square inch; indicator valves, and valve posts with lock attachments, which attachments form a new feature and are shown for the first time. The boiler plant of the Exposition is furnished with several Kennedy valves. Mr. P. Hartenfels takes much pleasure in describing the merits of these valves.

THE ANCHOR ELECTRIC COMPANY, Boston, makes an exceedingly fine showing, and its handsome display board attracted much attention. In the centre of it appears in the form of a horseshoe the name of the company, conspicuously presenting by this means its lamp-sign attachments. President H. C. Hawks, Vice-President Norman Marshall, and Treasurer P. M. Reynolds were in attendance during the convention, as well as A. B. Feld, the New York representative, who is in permanent charge of the exhibit.

THE WARREN ELECTRIC COMPANY exhibits a Warren alternator which is belted to a 90-hp Weston engine. The Warren alternator is well-known as not having any moving wire and can in a few moments be wound for any voltage or for two-phase currents. The well-known firm of Wendell & MacDuffie, New York, represent the Warren alternator in New York, and Mr. H. P. Hill was active at the exhibit in welcoming visitors and showing the operation of the apparatus. Mr. Julian Scholl represented the Weston engine.

THE AMERICAN STOKER COMPANY, Dayton, O., is exhibiting a section of one of its furnaces, the method of operation of which is quite novel. The coal is fed in from below by means of a very coarse screw and rises upward to the fire bed. As it approaches it, it cokes and the fuel gases pass through the red-hot coal and are burned. The ashes and refuse, which is a most incombustible slag, falls over the edge of the fire and is removed. A forced draught supplies the fuel with air. Mr. Henry Stoddard, Jr., represents and explains.

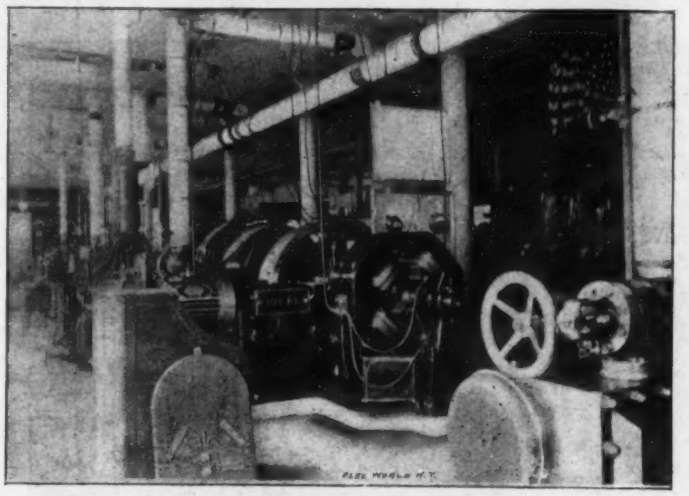
EYANSON & ARMPRIESTER, Philadelphia, showed a fine specimen of their switchboard work in the exhibit of the Chapin-Douglass Electric Company.

EXHIBIT OF EYANSON & ARMPRIESTER.

There are two complete boards shown. They are fitted with Weston instruments and Eyanson & Armpriester feeder and circuit switches. This firm makes a specialty of switches, switchboards and tablet-boards, and the boards on exhibition bear evidence of excellence in workmanship and material.

THE UNITED ELECTRIC IMPROVEMENT COMPANY, Philadelphia, makes a large and interesting exhibit, the principal feature of which is an alternator of 750-light capacity. It is part of a model lighting plant. The technical interest lies in the reactance system of arc lighting. No transformers are used and the regulation is claimed to be perfect. There is also quite a large exhibit of Keystone lamps. The company is represented in the exhibition hall by Mr. W. Eugene Smith.

THE WESTON ELECTRICAL INSTRUMENT COMPANY, of Newark, N. J., has a fine display of the instruments which it manufactures. Among the most



PORTION OF GENERATING PLANT.

interesting are two ammeters, one with a capacity of 10,000 amperes and the other one, which is the largest ever made, has a capacity of 80,000 amperes. They are of the illuminated-dial type. The edgewise system instruments, the laboratory standards and the portable instruments add much to the beauty of the exhibit. Mr. A. J. P. Prounie is in charge.

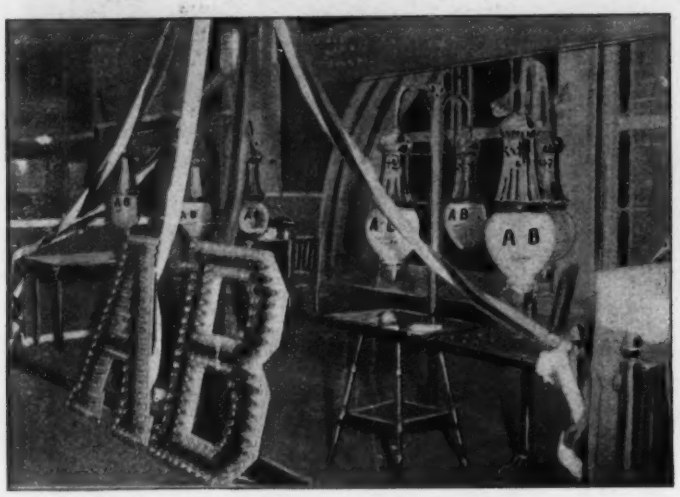
THE HEINE BOILER COMPANY, St. Louis, Mo., exhibits a complete sectional model of its 250-hp boiler. Among the features of this boiler is the steam-separator arrangement which causes the steam to break over a sharp edge before it leaves the boiler and tends to throw the water to the rear of the boiler and increase the circulation. An internal mud drum in which the water is fed is also a feature. The boiler has many other features of acknowledged merit and Messrs. R. T. Walker and H. F. Van Zile were busy in explaining them.

THE SAFETY INSULATED WIRE & CABLE COMPANY, New York, has a large exhibit of cable samples, arranged so as to show each variety of cable made by the company. Cross-sections of each cable are also shown. A feature of the exhibit is illuminated signs displaying the name of the company, the factories, and other pictures and legends. The signs automatically light up and extinguish every ten seconds. The company is represented by Messrs. H. T. Richards, L. R. Clark, Jr., Ira W. Henry, A. P. Eckert and L. F. Requa, Jr.

MR. H. D. STANLEY, now connected with Mr. W. R. Brixey and the "Kerite" wire manufactures, must have been more than delighted over the hearty congratulations of which he was the recipient. For his benefit be it told that, out of his presence, similar expressions were as generally manifest. A convention would not be complete without the presence of the genial Stanley, who enjoys enviable popularity in the electrical field, and congratulations were mutual as between Mr. Brixey and himself and their present business relations, with the best wishes that the union might never be broken.

The Mica Insulator Company, New York, has an extensive display of micanite specialties. Some of the features are two large molded rings of micanite, 5 feet in diameter; an armature with micanite insulation and a commutator of the same material. There are also specimens of segments, special rings and other shapes, such as are used in dynamo construction. The exhibit is very complete, and in fact is an object lesson showing how largely mica can be used in electrical work. The company is represented by Messrs. C. W. Jefferson and Edward C. Wood.

The Adams-Bagnall Company is very much in evidence with its fine exhibit of arc lamps. These lamps are adaptable to all conditions of service. They are very artistic, and the interchangeable parts can be changed in a few moments to adapt the lamp to service on any circuit. The Adams-Bagnall Company has in its employ some of the veterans in the manufacture of arc lamps, and it would be strange if its product was not superior. Messrs. L. H. Rogers, A. D. Dorman, A. B. Caldwell, and E. J. Bagnall are on the scene ready to welcome visitors.



The Adams-Bagnall Company Exhibit.

The Fort Wayne Electric Corporation exhibit makes a fine appearance. A fully equipped switchboard shows off the apparatus of the company to perfection. There is a rotary transformer receiving direct current from the main line adjusted to drive an alternator which drives a 10-hp and a 2½-hp alternating motor. This transformer will transform in either direction. There are also a sub-station transformer, primary fuse boxes, meters, switches, etc. The ammeters and voltmeters are worthy of special attention. Mr. F. H. Leonard, Jr., is in charge of the exhibit.

Mr. W. F. Bossert, Utica, N.Y., exhibits a switchboard fitted with all of his new cabinets for interior conduit wiring systems. These boards are of cast iron and arranged either for a flush cabinet or surface system and are suitable for brass or iron armored conduits. They are fitted with bus bars with contacts for the distributing circuits and arrangements for fusing: also main switches to cut the cabinet in circuit. Junction boxes, chandeliers, cut-outs and a large line of goods are displayed. The exhibit is very attractive both from an æsthetic and professional standpoint.

The Bishop Gutta Percha Company, New York, has an interesting exhibit, which includes the following features: Crude gutta percha and rubber is exhibited in various stages of manufacture, as is also a line of well-known Bishop wires and lead-covered cables. Some interesting material which is almost historical is shown in the shape of a section of a copper cable which ran to the Sandy Hook light buoy, and a gutta percha pipe which was used in 1848 for supplying Blackwell's Island with water. A full line of lamp cord is shown. Mr. H. A. Reed is present much of the time.

The Herzog-Teleseme Company, New York, exhibits some of its ingenious apparatus for communicating between points. Its famous elevator call is shown in operation and its liquid annunciator attracts a great deal of attention. The police call is arranged to be worked in a similar manner, only that the apparatus is built somewhat more substantially in order to withstand the rougher usage which it is likely to receive. In addition there are emergency calls and local substation calls which may be operated without even opening the board. Messrs. A. W. Hoppin and W. C. Gage are in charge.

W. R. Fleming & Co. and H. B. Coho & Co., New York, exhibit an Ideal engine driving a 40-kw Eddy generator, to which it is directly connected. The whole is mounted upon three points of support only, yet it runs noiselessly and without sensible vibration. The performance is rather remarkable and is attracting considerable attention. Mr. A. D. Newton, of the Eddy Company, is in attendance, and he, as well as Mr. Fleming, Mr. Coho and the Harrisburg Foundry & Machine Company, the manufacturers of the engine, may well feel proud of the general attractiveness of this display.

The Borne Scrymser Company, New York, exhibit high grade lubricant oil for all purposes. A handsome sign constructed of miniature lamps in various colors, showing the name of the firm, underneath which in red lamps is the name of the oil. The exhibit consists of six natural oak barrels, the heads of which are painted in colors and the hoops of which are of nickel. The greater portion of the oil consumed in the Exhibition Hall is furnished by this company. Mr. J. H. Torrey, who is in charge of this exhibit, as may be expected, is an oily talker. He is assisted by Mr. A. W. Corning.

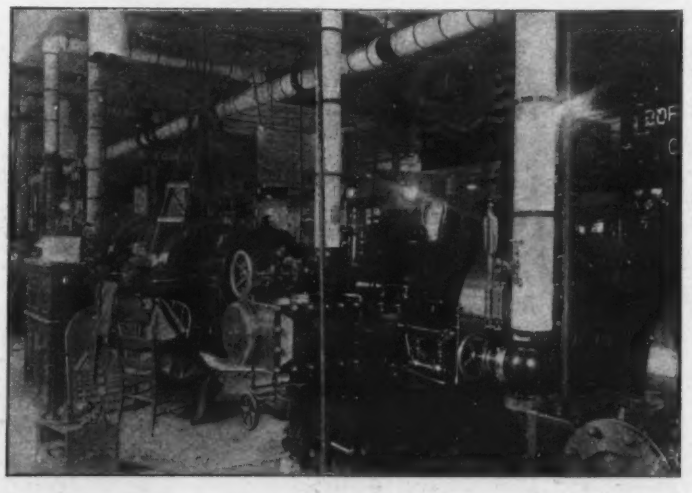
The Niles Tool Works, Niles, O., exhibit some of their special machinery which is used in general machine shop work and particularly applicable to the manufacture of electrical apparatus. Vertical and horizontal boring machines which are especially adapted to difficult work and which operate with accuracy and dispatch, form a prominent feature. The vertical boring machine is direct-connected to a Card motor of the Card Motor & Dynamo Company's manufacture. At the rear of the booth is a large radial drill, which is capable of drilling a hole in a casting in any direction. Mr. E. D. Becker is in attendance.

The Crouse-Tremaine Carbon Company, Fostoria, O., makers of electric light carbons, was represented at the convention by Messrs. J. B. Crouse and H. A. Tremaine, president and treasurer of the company respectively, and H. S. Hart. Some of the specialties on exhibition are cored carbons for constant-potential and series-arc lamps and also solid carbons for series-arc generators, motors and dynamo brushes. The booth was handsomely decorated with carbons of all descriptions and lighted by an Adams-Bagnall arc lamp. The company has just completed arrangements for an Eastern representative in New York.

The Diehl Manufacturing Company, Elizabethport, N. J., is much in evidence, with an exhibit of direct-connected ceiling fans, arc lamps, motor-driven sewing machines, and a direct-connected motor and dynamo. Mr. J. C. Knight, who represents the company, claims a special merit in the sewing machine, because no belting is used in the application of the motor. The Diehl direct-connected motor and dynamo have already been described in the pages of The Electrical World. The ceiling fan has been before the public for several years, and is a prime favorite and a good seller. The arc lamps have also met with flattering success.

The Sprague Electric Elevator Company, New York, exhibits two complete equipments, one of the screw and ball-nut type and the other of the tandem worm type. The exhibits are ultimately to be shown in operation and have several new improvements, although in the main the apparatus is practically the same as has been frequently installed and has given such successful results. Among the improvements is a special device which puts a check on the operator and prevents his drawing an excessive current, however he may manipulate the controlling buttons. Messrs. P. R. Moses and M. B. Kittle are showing the apparatus to interested visitors.

The Jewell Belting Company, Hartford, Conn., displays a section of the huge belt manufactured for the Washburn & Moen Manufacturing Company—the largest leather belt in the world, which is 118 feet long, 79 inches wide and one inch thick, four-ply, weighing 3208 pounds; also a 69-inch three-ply belt just completed for the Norwalk Electric Light Company, and a 125-foot, 48-inch two-ply belt made for the New Jersey & Passaic Electric Light Company. Messrs. C. E. Newton and C. E. Tolles were in attendance during the convention and also Mr. Charles E. Ainsworth, New York agent, who will have charge of the exhibit during the Exposition.



Another View of Generating Plant.

The Babcock & Wilcox Company, New York, represented by Mr. William J. Reilly, who was the superintendent of lighting at the Columbian Exposition, exhibits portions of its boilers, including the forged headers steam drums, and also a large sample board illustrative of its high-pressure steam fittings. An ingenious sign, designed by Mr. Reilly, consists

of a number of boiler headers secured against the wall, the round holes of which are stopped by circular pieces of glass upon which are ground bright red letters. Lamps are placed in the interior of the header and cause the letters to become brilliantly luminous, making the sign at once significant and attractive.

The Walker Company, Cleveland, O., had no regular exhibit, but Mr. H. McL. Harding was on hand as usual.

The Peckham Motor Truck & Wheel Company thought the Exposition of sufficient interest to street railway men to engage space and exhibit wheels and side frames of its truck. Mr. E. H. Long represents the company.

The Wagner Electric Manufacturing Company has a booth in the northwest corner of the main hall, in which the company exhibits its well-known transformers, which are equipped with their new patent fuse block, enabling an exceptionally long fuse to be used and removed, and replaced without danger of burning the fingers or getting a severe shock. Wagner fan motors and also a line of switches for heavy currents provided with flash contacts are shown and interest many visitors. Mr. E. H. Abadie, Mr. H. A. Wagner and Mr. John Mustard represent the company.

The Standard Underground Cable Company, Pittsburg, exhibits reels of its standard fibre insulated cables, standard paper insulated cable and standard rubber insulated cables, and makes a specialty of samples of some of its most important recent contracts. It has a show rack for wires and cables, and small samples, especially of lead-covered cables, for distribution, and will distribute a novel electrical souvenir. The following named representatives of the company are in attendance: Manager G. L. Wiley, of New York; General Superintendent W. A. Connor, of Pittsburg; Edward Sullivan and A. B. Saurman, of New York.

The Westinghouse Electric & Manufacturing Company, Pittsburg, Pa., represented by Malcolm McLaren and Arthur Zimmermann, exhibits its apparatus in the booth of the United Electric Light & Power Company. The two-phase motors have been previously mentioned, but the single-phase self-starting synchronous motor forms an additional interesting feature. The exhibit is lighted with the well-known Sawyer-Man incandescent lamp, and the well-known Shallenberger meter is shown. A large number of converters of various types also forms a feature. Beside the regular attendants, Messrs. C. F. Scott and E. H. Heinrichs, of Pittsburg, and Mr. Allen from Philadelphia, were present.

The Carpenter Enamel Rheostat Company, Hoboken, N. J., has its usual attractive display of goods. Among some of the new features is its new method of making rheostats wherein a portion of the conductor is left uncovered, by which means it has been found that heat can be more rapidly radiated, and panels of a large capacity can be made much smaller than heretofore. The motor-rheostat which opens circuit either for failure of the line or overload is an ingenious feature. This rheostat not only opens the circuit but cuts in the starting resistance. The company is represented by Mr. Boyd Thistle. Messrs. H. Ward Leonard and C. E. Carpenter were also in attendance during the convention.

The Western Telephone Construction Company, manufacturers of telephones and telephone apparatus, Chicago, is showing a full and very unique line of various styles and systems of telephones, including an exchange system for 25 subscribers, giant double-X long-distance telephone, dynamic phones, portable desk phones, oxidized copper and nickel swinging-arm desk sets; also a power generator, and an improved fire-alarm system. Recent plants installed by this company are as follows: Exchange systems, Elizabeth, N. J., 300 phones; Richmond, Va., 2000 phones; Fort Wayne, Ind., 1000 phones. The company is represented at the Exposition by Mr. J. A. Russell and Mr. W. W. Bostwick, Jr.

The Gordon-Burnham Battery Company, New York, has a handsomely decorated booth, in which the company exhibits what it and many a user consider to be the best primary battery in existence for either open or closed circuit work. The battery is equally good for either of these services and is therefore adapted to all of the uses of electric batteries. The voltage is about one volt per cell and the internal resistance is extremely low. The cells are shown operating an induction coil which in turn actuates some very handsome Geissler tubes. The smallest cel will give eight amperes on short circuit. Mr. R. W. Gordon, vice-president, and Mr. W. C. Banks, electrician of the company, are in charge of the exhibit.

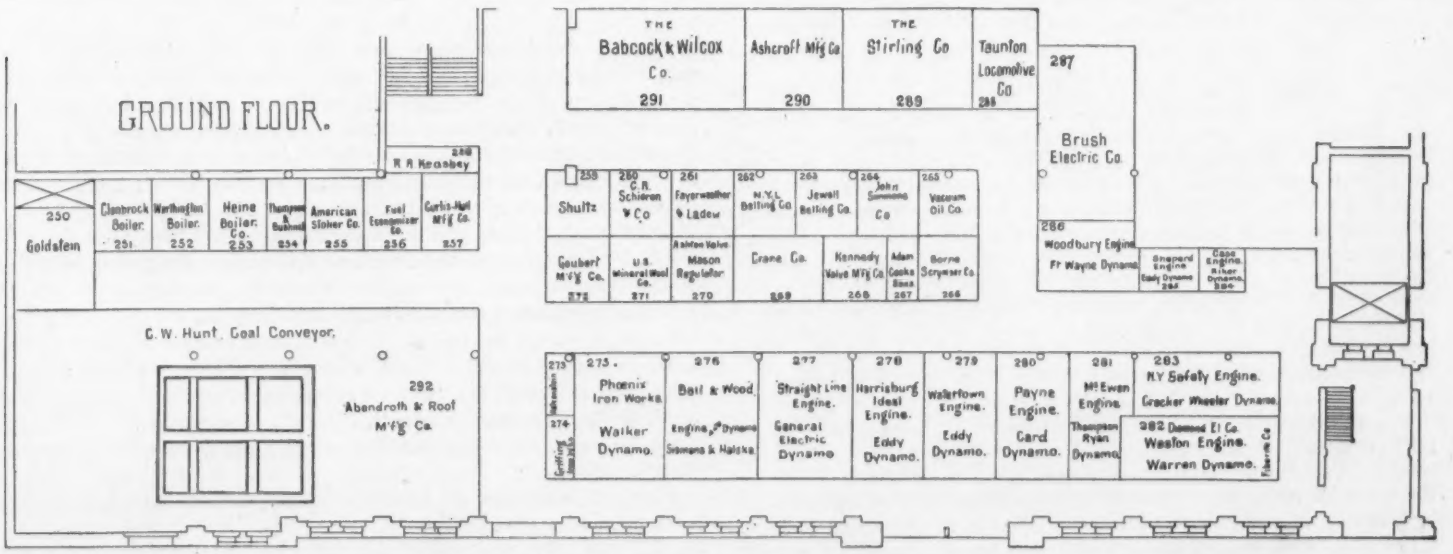
The Shultz Belting Company, St. Louis, Mo., is represented by Mr. A. B. Laurence, its New York agent, but Capt. J. A. J. Shultz, president of the company, was also present during the convention. The company exhibits samples of its belting from 72 to 4 inches in width, also rawhide belts, grooved belts, woven link belts and patent pulley covering. The well-known trade mark of the Shultz Belting Company was illustrated by an interesting little model of a set of rotating spheres representing the earth and moon connected by a Shultz belt. To the casual observer it seems impossible for the belt to stay on such an apparently insecure surface. Mr. Laurence and his son, Mr. A. C. Laurence, assisted by Charles Dunthorn, successfully produced the model.

The Electric Storage Battery Company, Philadelphia, has an extensive exhibit close to the auditorium. In the rear of its exhibit 128 cells working on the Edison system are shown in operation, while an electric launch with a capacity of five miles an hour for three and one half hours and an electrical carriage of a capacity of 25 miles at ten miles an hour, interested a great many people. A large cell of a type suitable for electric light stations having a capacity of from 4260 to 3000 ampere-hours and a discharge rate of from 426 to 1000 amperes is an attraction to electric light men. A storage battery switchboard is an additional feature. Mr. Charles Blizard, general manager of the New York office, Mr. W. O. Knudson and Mr. D. M. Rundle are in attendance.

The Calculagraph Company, New York, exhibits its instruments in a very attractive manner. It machine records elapsed time. A ticket is printed, and after a certain time has passed or an event taken place it is again printed and it then bears a record of the exact amount of time elapsed. Any number of tickets may be printed at intervals, and yet the records will not be confused. The mechanical arrangement for accomplishing this is as ingenious as it is simple. By graduating the dials for dollars and cents instead of for minutes and seconds, the exact amount of money for a certain service at a certain rate per hour will be recorded without any computation. Messrs. H. Abbott and H. Hamilton explain the instrument to those who are interested, of which there are many.

The Cutter Electrical & Manufacturing Company has a fine exhibit of flush switches, circuit-breakers and similar appliances. Among the attractions displayed is the principle of their circuit-breaker, which they have named the "inverse time element" circuit-breaker, "I. T. E." This circuit-breaker is not dependent upon the friction of a catch and the tension of a spring, but upon the rising of a plunger into the magnetic field which strikes the trigger a blow. The circuit-breaker, therefore, is entirely free from the errors of variable friction. They have combined this inverse time element in an overload and underload motor circuit-breaker which will break the circuit when the current is excessive or when it fails. Mr. S. I. Nicholson and Mr. W. E. Harrington are in charge of the exhibit.

The United Electric Light & Power Company, New York, has combined with the Westinghouse Company in a very interesting exhibit of two-phase apparatus. This company proposes to sell power from its two-phase generators at the Twenty-eight Street station and thus maintain a day load. Several two-phase motors, one of which was in operation, are


GROUND FLOOR.
THE Babcock & Wilcox Co. 291
Ashcroft Mfg Co 290
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C.W. Hunt Coal Conveyor
292 Abendroth & Root Mfg Co.
273 Phoenix Iron Works Walker Dynamo.
274 Corliss Engine
275 Bell & Wood Engine, Dynamo Siemens & Halske
276 Straight Line Engine. General Electric Dynamo
277 Harrisburg Ideal Engine. Eddy Dynamo.
278 Watertown Engine. Eddy Dynamo.
279 Payne Engine. Card Dynamo.
280 McEwen Engine. Thompson Ryan Dynamo
281 N.Y. Safety Engine. Crocker Wheeler Dynamo
282 Diamond El Co. Weston Engine. Warren Dynamo.
Electric Co

Ground Floor Plan of Exposition.

exhibited and elicit much favorable comment. The alternating system was illustrated in a series of striking experiments. The rotary field which sets in motion discs of metal and hollow egg-shaped bodies, attracted a great deal of attention, while the lighting of a lamp from the coil in no way connected with the energizing circuit was mystifying to the uninitiated. Mr. H. W. York with numerous able assistants represents the company.

The Geo. A. Macbeth Company, of Pittsburg, Pa., have a very attractive exhibit at the Exposition, where they are displaying their holophanes, a globe specially adapted for electric and gas lights. A large number of different shapes and sizes of their globes are now being prepared and by the Fall of this year the company expects to have all necessary styles for house, street and public building illumination. Mr. C. J. Miller, the well-known electrical engineer of Pittsburg, is in charge of the exhibit.

The Electric Arc Light Company, New York, has a fine exhibit. It comprises the various arc lamps the company builds, which are not only shown in the company's own booth, but a large number have been kindly loaned to illuminate many other booths, including that of The Electrical World. The lamps are of the enclosed arc type and completely consume the carbons, which have a remarkably long life. The light is thoroughly and uniformly diffused, leaving no dark bands across the globe. The company has named the lamp the "Pioneer," and an inspection of the catalogues which the company is giving out will show that its mechanism is wonderfully compact and simple. The president of the company is Mr. Lionel Sutro; treasurer and electrician, Louis B. Marks, secretary, William C. Hubbard.

The Abendroth & Root Manufacturing Company, New York, exhibits the only working boiler plant in the Exposition, which supplies steam to all of the engine exhibits. A Wilkinson automatic stoker is used and distributes the coal upon the fire in a very efficient and effective manner. From five to six tons of coal per day are used and 13,000 pounds of feed-water per hour. The evaporative efficiency is from 10 to 11 pounds of water to a pound of coal. The Hunt conveyor is used in removing the ashes and coal. The entire exhibit is in charge of Mrs. Frank Walton, chief engineer, who is possessed of a surprisingly large amount of practical knowledge of stoking and firing boilers, their efficiency and operation. Others in charge are Messrs. J. Avery, superintendent of construction, and John Kallery, assistant engineer.

The Bryan-Marsh Company, New York, represented by Converse D. Marsh and John I. Solomon, has a booth which is sure to attract attention. Among its interesting features is a large sign consisting of a board covered with ground glass bunghole lamps placed as closely together as possible and surmounted by the imperial trade-mark in miniature lamps. This board is wired so as to depict the portraits of various eminent men successively, each by the throw of a switch, and attracts a great deal of attention. Mr. Marsh also displays a diagram in miniature colored lamps representing the curves of a recent test of his lamps and those of a competing company. It is a most ingenious and attractive way of making results public. In addition, a sample of every type of lamp made by the company is displayed, and forms a collection so large that considerable time could be devoted to even a cursory examination of it.

The Crocker-Wheeler Electric Company, New York, is exhibiting machines which are larger than any it has heretofore produced, but of the same grade of excellence which has marked the company's smaller types. The armatures are shown in the process of winding, and finished, and a complete generating set direct-connected to an engine is also exhibited. Motor-generators adapted to charge storage batteries, with an ingenious method of breaking circuit by means of hinging the field magnet are of great interest to technical experts, and a small drill press direct-driven by a motor is shown in operation. A gravity drop arrangement which does away with all springs is applied to the motor cut-out and opens the circuit when the line fails. The operator is then compelled to throw in a starting resistance before he can close it again. Messrs. H. L. Lufkin and F. B. De Gress explain the apparatus to great numbers of interested visitors.

The Columbia Incandescent Lamp Company, St. Louis, Mo., is presenting a very attractive exhibit in a tastefully decorated booth near the main hall. The company illustrates the process of making its filaments, and prides itself on its extremely uniform product. An interesting historical exhibit consists of the original Goebel lamps which were used by the Columbia Incandescent Lamp Company in successfully defending its suits. A portrait of Henry Goebel, surrounded by miniature lamps, forms a portion of the exhibit. A sample of every lamp that the company produces is shown in a large case at the front of the booth; also a number of Crookes tubes suitable for Röntgen ray work, made of special glass and also of German combustion glass. The company is represented by the following officers: J. H. Rhotehamel, president; A. C. Garrison, secretary; C. E. Bibber and F. C. Wilson, Boston representatives; O. Hoppe, of New York, and A. Y. King.

The Nowotny Electric Company, Cincinnati, O., is exhibiting an arc lamp that is a decidedly new departure; it is an improved Jablochkoff candle. Two flat strips of carbon are arranged to point downward and the arc is formed at their tips. The strips are parallel and are separated by an air space, and the arc, once lighted, travels from the bottom to the top of the strips as they consume, without any regulation. A starting coil to start the arc is all that is necessary. One of the strips is stationary and the other is pivoted at its upper extremity so that it can be drawn away from contact at the end, with its mate, by a solenoidal magnet. The arc is held at the tips of the carbon strips by means of a directive-magnetic field surrounding it and in series with the lamp. Suitable arrangements are employed for short-circuiting and open-circuiting the lamp according as it is of the series or constant potential type. The lamp burns in an air-tight receptacle and takes about seven amperes. A number of Nowotny dynamos and motors are also shown, and a rheostat consisting entirely of carbon wafers attracts considerable attention. Messrs. J. S. Nowotny, W. M. Venable and L. R. Keck are present representing the company.

The Holtzer-Cabot Electric Company, Boston, has one of the most attractive exhibits in the hall. A very complete display of the large line of goods which this company manufactures is made. This includes bells, automatic dimmers, annunciators, burglar alarms, watchmen's time detectors, gas lighting cut-outs, magneto bells, etc. A fine line of power generators is also shown. These machines have been taken out of stock, and show the excellence of design and workmanship for which this concern is well known. A large number of new fans are in operation, and the company have kindly loaned a great many to the other exhibitors, which adds largely to the comfort of all concerned. The company's new type of fan is of excellent design, provided with a four-speed switch and is almost absolutely noiseless. Its ceiling fan, which is attracting a great deal of attention, is extremely small and compact, being but 7 inches in diameter and weighs complete less than 30 pounds. The display of small motors, both for direct and alternating circuits and special applications of the same is very interesting, and shows the wide uses to which these machines are put. The concern has shown its generosity in loaning a great many pieces of apparatus to other exhibitors and to those in charge of the lectures, which in many cases have been of great assistance and have been highly appreciated. Mr. Charles W. Holtzer, president of the company, was present during the convention week. Mr. C. E. De Lue is in attendance, assisted much of the time by Mr. David Chalmers, manager of the New York office.

The Brush Electric Company, Cleveland, O., now manufactures arc dynamos exclusively. Its exhibit is divided into two portions, an historical exhibit and a modern exhibit. The historical exhibit consists of the first Brush arc dynamo, which was sold in 1877 to parties in Baltimore, who ran it for 12 years. Also a 16-light 2000 cp arc dynamo, which ran the Fulton Worsted Mills, Fulton, N. Y., from September, 1879, to April, 1892, and a 40-light Brush arc dynamo, which was operated by the Berkeley Co., Providence, R. I., from Dec. 1, 1881, to May 19, 1893. The dynamos are in good condition, are exhibited just as they left the factory years ago, without the slightest repair. The working exhibit consists of a new 80-light 2000-cp Brush arc dynamo connected to a 60-kw 220-volt motor. Eighty double-carbon Brush lamps are hung about the exhibit and are operated therefrom. An interesting feature of this 80-light dynamo consists of the fact that three circuits are run from it, and therefore the voltage on any part of the machine does not exceed 1500 volts. This is a new departure and should find much favor. A 100-light 2000-cp and a 125-light 2000-cp arc dynamo are exhibited also. The attractiveness of the exhibit and its prompt appearance is due greatly to the personal exertion of Mr. Herman J. Douds, who directed its arrangement. Mr. I. R. Prentiss, an old Brush veteran, also represents the company, while Col. W. S. Rogers was on hand during the convention. Mr. S. M. Hammill, general manager of the Brush Company, expects to visit the Exposition once or twice, and Mr. C. M. Green, the head of the testing department, will also attend a portion of the time.

Results Accomplished in Distribution of Light and Power by Alternating Currents.*

BY W. L. R. EMMET.

The introduction of successful polyphase motors has constituted a very radical and important step in the development of the electrical art. The number of persons who realize the importance of this step is as yet small, and, like other new things, it cannot attain great successes until its merits and possibilities become more or less familiar to the public and to the practical business men on whom the responsibilities for new developments must largely rest.

In the past, the use of alternating currents has been almost exclusively for incandescent lighting, and this narrow limitation has crippled the development of the art. While the applications of direct currents have called forth very large investments in plants and distributing systems, the uses of the alternating current have, as a rule, been on a much smaller scale, and the methods used have been developed rather with a view to reduction in first cost than to the attainment of the most economical results in operation.

The reasons for this somewhat half-hearted development may be stated as follows:

First: The average efficiencies attained in most alternating plants have been very low.

* Paper read before the Nineteenth Convention of the National Electric Light Association, May 5, 6 and 7, 1896.

Second: The distribution of potential obtainable with the ordinary methods has been imperfect.

Third: No reliable alternating arc lamps have been available.

Fourth: No practicable form of single-phase alternating-current motor has, up to the present time, been introduced.

At no time have all these difficulties been entirely unavoidable in alternating-current distribution; they have, however, been fixed features of the system as it has in the past been installed by our manufacturing companies and used by electric light companies in this country; the state of the art being such that improvements were beyond the reach of most central station managers.

In recent years great developments have been in progress in the branches of electrical science pertaining to alternating currents; much new apparatus has been developed, plants have been installed on new lines, and practical results are to-day being accomplished that show that it is possible to overcome all of the objections which have been mentioned.

We will briefly review in order some of the means by which the difficulties mentioned have been and can be avoided.

Efficiency.—The greatest losses in the average alternating plant are due to the waste in iron cores of transformers, which goes on whether the transformers are loaded or not. This waste can be reduced, either by the use of transformers of high light-load efficiency, or by arrangements for cutting out transformers at light load.

Where primary distribution is used with large numbers of independent transformers, the extent to which these remedies can be adopted is very limited, since reduction of core loss can be obtained only at the expense either of regulation or of first cost.

If, however, secondary distribution is used, that is, low-tension mains with transformer sub-stations, it is often possible to arrange means of cutting out transformers at times of light loads.

Furthermore, on such systems very accurate regulation in transformers is a matter of no importance, since all transformers divide the load more or less evenly between them, instead of operating from the same line at various conditions of load as in primary distribution. Thus, for this secondary work, we can build special transformers having very small core losses and thus obtain very high all-day efficiency without impairment of regulation.

I have in mind a large plant now being equipped with alternating apparatus for lighting and power distribution on thoroughly modern and improved lines. In this case a system of three-wire, low-tension mains is to be laid over a large area. These mains will be fed at street corners from specially designed transformers in ventilated manholes. These transformers are to be of 100 kilowatts each, and are to have a core loss of only 500 watts, or one half of 1 per cent. of the capacity. The efficiency of these transformers at one-quarter load will be higher than at full load, the principal loss being in the copper. Thus a transformer may be made to fill the same functions as a direct-current feeder. If we are willing to introduce some drop between generator and main, we can get high light-load efficiency with moderate cost, and we shall retain the important advantage that transmission is possible over long distances, with small losses, through the use of high voltage.

In no branch of electrical work has the improvement of recent years been more marked than in the manufacture of transformers. This improvement has not been brought about by any radical discovery as to the principles involved, but simply by study of the economic conditions. The quality of iron is a most important matter in building transformers, and the methods of handling and annealing are almost equally so. Then the proportions by weight of iron and copper may be varied through a wide range, and the plan of arrangement of coils and iron are susceptible of endless variation. Every change of plan may affect the properties of the transformer as to self-induction, magnetizing current, hysteresis, eddy currents in core and copper, resistance loss and regulation. Thus there is much room for judgment in the design or purchase of transformers. At the price for which transformers can be bought it is folly to use bad ones. Thousands of transformers are in use to-day that are fit for nothing but the scrap pile, and many are now being manufactured and sold that are no better.

Regulation.—The cause of bad regulation in most existing alternating plants is that each individual installation is connected to a separate transformer, and that in these transformers, and the wiring connected to them, there are losses varying with the load, which, of course, cannot be controlled from the station. Since regulation is a matter of most vital importance, we see that with primary distribution good regulation in transformers is imperative. To make transformers of specially good regulation something must be sacrificed, either in economy of first cost or in light load efficiency, or in both. Thus there is always an appreciable drop through resistance of wire in transformers, and this, combined with the drop in primary and secondary wiring, gives rise to serious vibrations in pressure on lights at different points.

Another fruitful source of potential variations on alternating circuits is found in the self-induction of circuits and also in the self-induction of transformers. The E. M. Fs. introduced by self-induction being out of phase with the current, are variable in their effect, and give rise to troubles that sometimes seem erratic, although in reality they are governed by well-defined laws, which, if properly observed, enable us to obtain accurate results.

Motors.—Until very recently the operation of motors from alternating systems has been practically out of the question, since no suitable motor has been obtainable. Thus alternating apparatus has been available only for lighting, while in direct-current stations motor load during the day has been a most important source of profit. It may be mentioned here that while incandescent lighting is at the present time meeting sharp competition from either forms of illumination, the electric motor is growing very rapidly in popularity. It has taken the public a long time to gain confidence in electric power and to realize its usefulness. It is only within very recent years that large manufacturers have begun to use electrical power distribution to any great extent. At present the work is being carried on very actively, and highly successful and economical results are being obtained in many large mills. As a means of power distribution, even for short distances, electricity has no rival; while for lighting, its advantages, though great, are relatively much less positive.

Although for many years efficient electric motors have been in general use, there are many central stations in whose business power distribution has not been a very important factor. There are several causes which have tended to restrict the use of electric power, among which we may mention the following:

Voltages that have been available for direct-current work have not admitted of transmission to considerable distances.

Motors have required a certain amount of attention, which users were sometimes unwilling to bestow.

In certain classes of manufacture, the sparking of motors has been a source of danger.

The most important cause, however, has been that, as a rule, the same apparatus has not been available for the operation of lights and motors; consequently, central stations have not been in a position to make attractive propositions to large users of power.

The introduction of good alternating-current motors has opened a new era in electric power distribution, and seems to promise a great extension of its uses. With these motors the difficulties of distance are practically eliminated, since there is virtually no limit to the voltage which can be used. The mechanical features of the motor are near perfection, since it requires no care save what must be bestowed on its self-oiling bearings. These motors can be so arranged that they may be operated with perfect safety in any part of a powder mill, or oil refinery, and, in fact, a number of them are being operated now in highly explosive atmospheres, where a spark would work destruction.

With facilities for electric power transmission thus improved, we may look for great developments in the sale of power from central stations. When it is profitable for large manufacturing establishments to put in electric plants for the purpose of distributing power on their own premises, there should certainly be profit in the sale by electric companies of power to large as well as small manufacturers.

The actual saving in fuel effected in the operation of a large mill by electricity for power distribution is ordinarily very large; often as much as 50 per cent. With good equipment, this is, however, only a small part of the saving effected by electrical distribution. The cost of coal seldom amounts to more than half the expense incident to the production of power, and in most cases it is a much smaller proportion of the total. If power is obtained from a central station, the coal is bought cheaper and used more economically, while the other items of expense will in many cases be almost a clear saving.

The introduction on any large scale of electrical-power distribution, of course, requires the investment of a good deal of money in motors and alterations of plant. Power users are often slow to make these investments, because they are not familiar with electrical apparatus and do not realize the advantages to be gained. Repeated investigations have proved that users almost always far underesti-

mate the cost of power. It is the business of the central station manager to correct these misconceptions, and to awaken interest in electrical methods. Of course, many companies are working zealously just on these lines. There is no question, however, that there is in many of our large cities a large amount of undeveloped power business. If electrical manufacturers can induce large mill owners to put in plants for electrical-power distribution, central stations should be able to sell power to similar concerns.

The following facts concerning sale of alternating power apparatus by one company alone will illustrate the hold which the modern improvements above mentioned have already taken upon the industry of the country.

The first three-phase apparatus made in this country was put in operation two and a half years ago. Since then that company has put in operation 33,500 horse-power capacity in three-phase generators; 10,000 horse-power in three-phase induction motors; 14,800 horse-power in monocyclic generators; 6000 horse-power in three-phase synchronous motors; 10,560 horse-power in rotary converters and 42,000 horse-power in transformers used for power purposes;

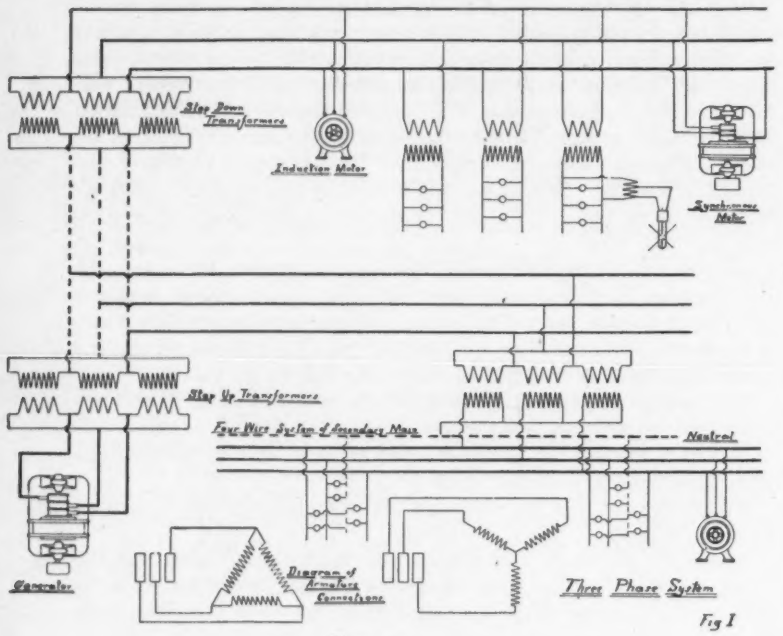


FIG. 1.

the average capacity of the latter being 16 horse-power and the largest having a capacity of 1100 horse-power.

The production of this apparatus has involved the complete design and development of about 30 new forms of dynamos and 33 new forms of motors; each machine so developed involving the construction of new patterns and special tools, which, with drawings, etc., cost in the average about $1000 for each new machine.

The development of so large a number of different machines has been made expedient by the engineering conditions that have been met. The matters of speed, frequency, voltage and capacity must all be considered in deciding upon the best apparatus for any given purpose; and, of course, it is, generally speaking, unwise to use anything unsuitable, even though it be of standard production and for that reason desirable. The expense involved in the production of all these machines is great, but it is in the long run money well invested, since it puts the manufacturers in a position where they can bid to advantage on the apparatus best suited to any case. It also brings a fund of experience that may be of more value than the tools, patterns and drawings.

The uses to which all this apparatus has been put are various. All sorts of new problems have presented themselves, and have been solved in widely different ways suited to the conditions. In many cases the apparatus built has been of types radically different from anything previously produced. In the past, the principal production of American electrical manufacturers has been from standard lines of apparatus, and we still endeavor to keep up this most economical and excellent practice. Since, however, we are now constantly called upon to produce special apparatus, we try to so standardize and systematize our methods that new work can be turned out promptly and economically and without risk of failure.

The different methods of distributing power and light by alternating currents can best be illustrated by diagrams showing the connections used with each. We will briefly review some of the applications of the systems now in general use.

Fig. 1 shows the three-phase system as ordinarily applied to the transmission of power for lighting and other purposes over long distances. The generator may be of any convenient voltage, since step-up transformers are used. These transformers are in three units, or groups, any two of these units being available to transmit a large proportion of the power in case one is disabled. Two sets of step-down transformers are shown, one supplying 1000-volt distributing lines, and the other supplying a system of four-wire secondary mains. With a given lamp voltage, such mains give a slightly better copper economy than the ordinary three-wire system, and afford an excellent means of secondary distribution.

Such a system as is illustrated in this figure will give excellent service in almost any town, the low-tension mains taking care of the thickly built up portion and carrying the bulk of the lighting load, while the high-tension distributing system covers all outlying portions and operates large power units. A number of large plants have been installed within the last two years, using the three-phase system, as here shown.

Fig. 2 shows the connections for distribution by the monocyclic system. Here all lights are connected single-phase between a single pair of conductors leading from the generator, the motors

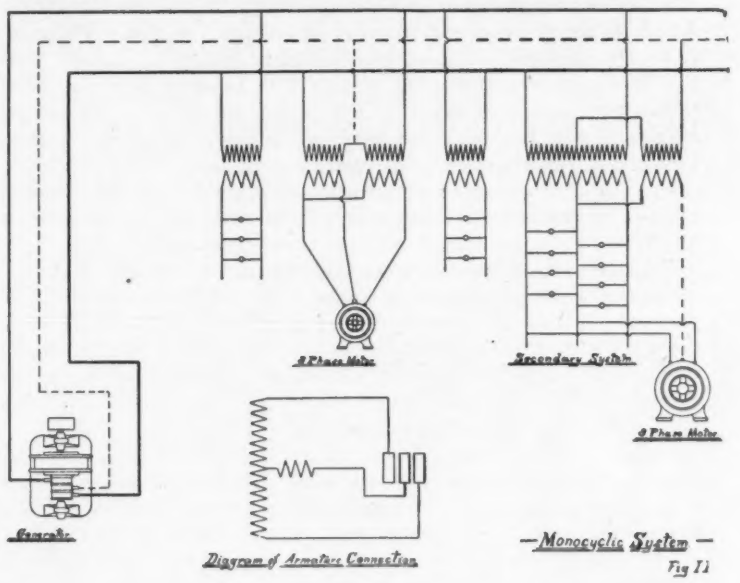


FIG. 2.

being operated from the same single-phase circuit in combination with a third conductor leading from what is known as the "teazer coil" on the generator. Here the simple three-wire system is used for secondary distribution, and if it is desired to connect motors to the low-tension mains, a supplementary transformer is used, which supplies a secondary teazer wire; to this and the outside wires of the three-wire system the motors are connected.

(To be continued.)

A Curious Röntgen-Ray Effect.*

To the Editor of The Electrical World:

SIR:—Permit me to send you a photograph made by means of the Röntgen rays and which to me appears interesting. It is that of two feet, one bare, the other booted. The white figures which are seen thereon and which appear to be radiated from a white point or a white line correspond exactly, in the case of the bare foot, to the perspiration which covers the plate holder near the point of contact. In the case of the booted foot it corresponds to the right side of the sole which touches the plate holder. Now, it is quite certain that in this latter case the perspiration has not penetrated the sole in order to reach the photographic plate holder. We already know that water is transparent to the Röntgen rays, but how can it communicate this transparency to the bones themselves, to the nails and even to the strip of iron which is found in the sole of the boot and the anterior extremity of which is covered by the white figures? The large transverse bar which appears darker under the bare foot corresponds exactly to a strip of copper which is in the plate holder back of the sensitive plate. The bottom of the plate holder is formed by a thin plate of iron coated with varnish. F. C. K. LAFLAMME

UNIVERSITÉ LAVAL, QUEBEC, CAN.

* See illustration on page 547.

DIGEST OF CURRENT TECHNICAL ELECTRICAL LITERATURE

BY CARL HERING

COMPILED FROM THE PRINCIPAL FOREIGN AND AMERICAN JOURNALS

DYNAMOS, MOTORS AND TRANSFORMERS.

Small Motor. *L'Elec.*, April 25.—An illustrated description of a small motor called the "Baby," and intended for 110-volt circuits, consuming 150 to 200 watts; the armature is of the Gramme type.

Motor Regulation by Field Variation. ANTHONY. *Elec. Eng.*, May 6.—An unfavorable discussion of the Burke system, which was described in the *Digest*, April 25; he points out the great size of the machine that would be required; the usual condition to be satisfied is more nearly that of constant torque than of constant power; to deliver a given horse-power at widely varying speeds is an extremely rare case; by making one machine capable of delivering 10 horse-power at 100 revolutions, which would be cheaper than two machines of 5 horse-power each, the speed regulation could be obtained by varying its own field with the same facility as by the Burke method; the latter's method will require to deliver 10 horse-power with a range from 100 to 500 revolutions, two machines of such size that they would, if properly wound, give 25 horse-power each; if the power is to increase with the speed, as for a street car or elevator, with 10 horse-power as a minimum, then the two motors would have to be of such sizes that if properly wound they would deliver at least 125 horse-power each at 500 revolutions.

LIGHTS AND LIGHTING.

Public Lighting by Arc Lamps. BLONDEL. Lond. *Elec.*, April 24; a continuation of his serial (see *Digest*, last week).—He describes the dioptric methods; in these there are two objects, the reduction of the losses generally accompanying diffusion and the distribution of the light in the most advantageous manner without sacrificing diffusion. The principle of dioptric diffusion is to cover the globe, which is made of transparent glass, with a network of small refracting elements; plain ribbed glass, he says, is very bad from the point of view of diffusion; when there are two such sets of ribs at right angles the diffusion is much better, though the result is not perfect; a globe of this kind was made by Trotter in 1883, the ribs being horizontal on one side of the globe and vertical on the other; in this the diffusion was still imperfect and the losses considerable; in the Fredureau globe there were simple, prismatic external zones, the object being to reflect as much of the light as possible downward; no data is given other than a diagram and a photograph of a globe containing a light, which shows a broad vertical streak and numerous horizontal ones chiefly across the middle vertical diameter; these globes produce a distribution but not a diffusion; the loss is said to be considerable owing to the excessive internal reflection. He then describes, with the aid of a number of illustrations, the holophane globes, in which there are also double ribs, the profiles of the external ones of which differ from those in the preceding in their profile; each rib is a combination of two independent sections, one refracting and the other reflecting, and are arranged so as to suppress all acute angles; a very good diffusion is obtained over a considerable angle without any appreciable loss, and the globes appear to be luminous all over, as is shown by a photograph, the luminous surface being formed of an infinite number of small images of the arc close together; in the upper portion of the globe the ribs are designed so as to totally reflect the rays toward the centre of the globe and to escape the carbons.

Analytical Study of the Alternating-Current Arc. FLEMING and PETAVEL. *Phil. Mag.*, April.—A reprint in full, with all the numerous illustrations of the long Physical Society paper, abstracted in the *Digest*, March 28 and April 4.

Candle-Power and Luminosity. BIRCHMORE. *Prog. Age*, April 15.—He thinks there exists a confused state of mind regarding the practical application of the light of the various illuminants, fundamental facts in physics being persistently neglected and deliberately ignored; he believes this is due to the neglect of the obvious purpose for which the artificial light is used, and also to the abuse of the Bunsen photometer which is "now used for a purpose of which its inventor never dreamed." The intention of artificial illumination is to take the place of sunlight; 72 per cent. of the sunlight is orange, 17.7 per cent. yellow and only 10.3 per cent. of the others combined; over 60 per cent. of the light of the best artificial illuminants for domestic use is green and lavendar He discusses white light, the spectrum of reflection, ortho-chromatic light and allied subjects, and arrives at the conclusion that the Bunsen photometer has "quite overmastered the minds of those who are not interested in the said results beyond the comparison of two luminous shadows, while the reflection spectrum is not studied at all and the question of ortho-chromatism is not even raised. When this is reversed in the minds of the experts, when the question becomes how nearly ortho-chromatic is this light, and not what is the candle-power, there will be some chance of our getting a real improvement in artificial illumination, but not before."

Arc Lighting Practice. Dow. *Elec. Eng'ing.* April; a reply to the recent criticisms of Hesketh (see *Digest*, March 7).—He thinks there is much room for improvement in lamp supports, globes and carbons; the present practice regarding carbons is much better than it formerly was; the introduction of arcs on the constant potential systems has introduced the imported carbons with cores of different diameters, and the alternating arc was a failure until the proper carbon and the 30 to 33 volt adjustment were adopted; the ½ inch copper carbon is still used more generally for street lighting; the practice of using the partly burned uppers for the lower ones, are the factors which decided this; the worst fault of the uniform carbons is the tendency to overlap in the lamp, which is the cause of much of the trouble experienced; the results were far superior when ⅝ inch uppers were used with $\frac{7}{16}$ inch lowers. For interior work uniform carbons are no longer used and the use of larger uppers is frequent though not general; the difference between interior and street lighting lamps is discussed and the advantages of the former are pointed out; a series dynamo can be operated with differential lamps nearer to its maximum voltage than with shunt lamps, which gives the station the equivalent of a reserve of dynamos for emergencies; he thinks the enclosed arc will be used largely for private lighting and that it has passed the experimental stage.

Lighting by Holophane Globes. GUILBERT. *Prog. Age*, April 1.—The conclusion of the translation of the article noticed in the *Digest*, April 4.

Vacuum Tube Lighting. *Elec. Eng.*, May 6.—A reproduction of a photograph of the hall of the American Institute of Electrical Engineers lit by means of Moore's vacuum tubes, which were exhibited in connection with his recent Institute paper; the exposure was five minutes.

POWER AND HEAT.

Electric Metal Heating and Working. SACHS. *Cassier's Mag.*, April.—A well-illustrated article describing the various processes and their application in practice; it includes a table giving the energy absorbed in the Thomson process for a few metals and for different-sized pieces.

TRACTION.

Disturbances Produced in Telephone Lines. WIETLISBACH. *Elek. Zeit.*, April 23.—He discusses the causes of disturbances in telephone circuits due to lighting and railway currents and gives the remedies. The greater part is devoted to the subject of the disturbances due to induction; if the cause of the disturbance is not too strong the metallic circuit gives good results; when too strong the cure must be sought in changing the circuits carrying the strong currents, which should also be run in the form of loops, with the two wires as close together as possible and the distance between these and telephone circuits as great as possible; the use of metallic circuits gives good results only when the insulation is perfect at all points and the circuits relatively symmetrical throughout, which, however, is impossible for long circuits; with high-tension alternating currents and for distances of only a few hundred metres, a poor insulation, such as that produced by touching a tree, is sufficient to cause trouble; such induced currents, when produced in one telephone line, are transmitted to others, thus affecting a wide district; there is often nothing left to do but to lay the telephone wires underground. Another method is the use of "translators" (see below), which connect two wires "through the process of electromagnetic induction," to prevent a fault in the insulation in the one to be transmitted to the other; the effective capacity is also thereby reduced. In the only railway line in Switzerland (at Montreux) in which the double trolley is used, the effect on single telephone circuits is noticeable but disappears almost entirely for metallic circuits. In railway circuits the current is made undulating by the motor and by the contact with the overhead wire; this wire is set into vibration and produces a variation of resistance like in a microphone; on different lines even when the same system is used, the disturbances caused are quite different in amount and as a rule are less when the line is new, becoming greater after a number of weeks; the increase in the disturbances was noticed chiefly on those lines on which the trolley wheel was used, while it was much less on those equipped with the contact bar; for the trolley wheel system the wire must be exactly in the middle between the tracks, while for the other system this is not necessary and the number of supports may therefore be less, thus reducing the frequency of the vibrations of that wire, it being then so low that the vibrations are not within the limits of those which affect the ear;

railway circuits which produce no disturbances are no more complicated or more expensive than those which do, on the contrary they are thought to be even cheaper to maintain; those roads on which there is an underground conduit produce no disturbances; if the three-phase current is used, then all earth connections of telephone lines within a great radius must be abandoned.

Some of the questions are discussed editorially in the same journal; it is stated that his observations showing the advantages of the contact bar were made independently of those described by Preller (see *Digest*, Feb. 1, see also March 14); the editorial does not agree with him that the overhead contact is the chief cause of disturbances; if it were, the pitch of the note produced in the telephone would have to vary more than is the case, and it would have to be different on the curves, whereas it is well-known that it is the loudness and not the pitch which varies in passing over curves. It is suggested that the cause might be looked for in the contact resistance with the rails; the latter are set into vibrations, which affects the contact resistance and these vibrations would be greater on curves without being of an appreciably higher pitch; the changes which occur after a new line has been started may thereby also be explained, as the rails are at first tightly held and then gradually become loose; a test is said to have been made which confirmed this view.

Surface Contact System for Paris. Lauriol. *Rev. Gen. des Sc.*, April 15.—A long, well-illustrated description of the Claret-Vuilleumier system, which is being installed in Paris; it has been described and referred to a number of times in these columns; it is a surface contact system in which distribution boxes, one each for a series of contacts, are used; the contacts on the surface of the street are small, while the contact bar carried by the car is long enough to cover at least two of them; the work of construction is nearly completed, and it is thought the line will soon be started.

Braking Cars. Elek. Anz., April 19; an illustrated description of a patented system.—If in using series-motors it is desired to brake, by converting the motor into a dynamo, it is necessary to reverse the magnetic connections; in the present system this is done, not simply by reversing the connections, but by connecting the field to an accumulator which is charged from the circuit; by this means a regulation of the speed also becomes possible.

Insulation of Rails. Lond. *Elec. Rev.*, April 24; an abstract of the recent article by Lindeck (*Digest*, April 11), and of the editorial comment which was noticed in the *Digest*, April 25, including the computations.

Electricity on Steam Railroads. Baxter. *Elec. Eng.*, May 6.—A continuation of his serial (see *Digest*, last week.) He continues the discussion of the cost of repairs, and claims that those of the motors would amount to only 15 per cent. of the repairs of the locomotives; he thinks this low cost of maintenance is justified, in view of the fact that they would be much more substantial than those of small size now being used, as the designers would not be hampered with restrictions as to the size and weight. He considers the item of repairs to shop machinery and tools and calculates a saving of about 5 per cent.; the item of wages of engineers, firemen and round-house men, he considers of great importance, and thinks this item could be reduced by an amount which is about 36 per cent. of the entire charge of this service, and constitutes 2.8 per cent. of the total operating expenses; the cost of fuel for locomotives is considered, but the figures are only assumption; 65 pounds per train mile for passenger work, he thinks, is a fair average, and on this he bases some calculations, showing a percentage of fuel bills saved of about 72 per cent., or 6.5 per cent. of the total operating expenses.

The Return Circuit. Bell. *St. Ry. Jour.*, April.—A continuation of his serial on power distribution for electric railways, discussing the subject of the return circuit, including the bonding, resistance of earth returns, etc.; regarding the earth return he states that the earth not only has no high conductivity to assist the returning current, but it must for most useful purposes be regarded as almost a non-conductor, as its specific resistance is so high and irregular that it is of no value as a part of the return circuit, and its conducting power in great areas comes into play only in an unpleasant and troublesome way; for all long lines and many street railway systems, the earth may be left entirely out of account.

Operating Expenses of the Conduit Road in Washington. St. Ry. Jour., April.—Tabulated data giving the cost of propelling, heating and lighting cars for the month of January; the cars are 16 feet long and are run in trains of two. Among the general results are the following: average cost per train mile, 9.27 cts.; cost of power per train mile, 1.19 cts.; cost of car equipment and repairs per train mile, 0.96 ct.; total kw-hours per train mile, 1185; coal per kw-hour, 3.9 pounds.

Station Records at Trenton. Moore. *St. Ry. Jour.*, April.—Tabulated power station records for the line at Trenton for the past year.

Earnings and Operating Expenses of Connecticut Street Railways. St. Ry. Rev., April 15.—Tabular data for each of a number of these roads.

Power Station Records in Philadelphia. Elec. Ry. Jour., April.—Tabulated data for one of the lines in Philadelphia for the past four months.

Testing Stations for Street Railways. Conant. *St. Ry. Jour.*, April.—An article describing the testing station and the methods used, of the West End Company in Boston.

New Orleans. St. Ry. Jour., April.—A long illustrated description of the lines in that city.

Evolution of the Horseless Carriage. Spalding. *Cassier's Mag.*, April.—An illustrated article in which are included descriptions of a number of electric carriages.

INSTALLATIONS, SYSTEMS AND APPLIANCES.

Accumulation and Reserve in Installations. Massenbach. *Elek. Zeit.*, April 23.—An abstract of a recent paper in which he shows the advantages of accumulators in central stations. Heat storage as suggested in England does not form a true reserve, but only relieves the boilers, while accumulators deliver the electricity directly and therefore act as a true reserve, besides being more economical; they should not be made relatively as large as the gas holders for gas installations, as that would increase the cost and the losses, besides losing the chief advantages of the accumulators, namely that they enable the machinery to be stopped and thoroughly overhauled. Regarding the losses, he states that in Hamburg, where large batteries are used, it is only 1.2 per cent. of the average amount of electrical energy generated during the year; the chief advantages are the reliability and the uniformity of their action. A battery is best divided into two or more independent parts each fully equipped with its accessories; the increased cost is not very much greater as this cost, for large currents at least, is nearly proportional to the current; the chief application of accumulators is to cut off the peak of the load curve; in order that the batteries should not be too large or too expensive they ought to be capable of discharging with a high current density.

Lighting Statistics for Japan. Elec. Friend (Japan), February.—Statistics for the end of 1895, not including isolated plants, are as follows: There are 31 electric lighting companies, eight of which use water-power, and the others steam; the total number of incandescent lamps is 90,150, or reduced to their equivalent in 8-cp lamps, 138,327; the number of arc lamps, nearly all of which are of 1200 candle-power, is 420.

Three-Phase Plant at Kyoto. Elec. Friend (Japan), March.—A three-phase plant has recently been started at Kyoto, Japan, consisting of two Siemens & Halske generators of 2000 volts and 28 amperes; it is running very successfully, supplying both power and light.

Gas vs. Electricity as an Investment for Towns. Troughton. Lond. *Elec. Eng.* and *Elec. Rev.*, April 24.—A reprint of a short paper intended to show that a gas company in a small or medium-sized town is a better investment to the consumers of gas than is an installation of electric light, whether supplied by a company or by the municipal authorities; the former journal contains the discussion in full.

Municipal Ownership at Utica. Eng. News, May 7.—A brief summary of a recent report of an estimate for a 450-arc, street lighting plant of 2000-cp lamps, the generator to be capable of supplying 500 lamps; the cost of construction is estimated at $161,441; including depreciation and interest the annual out'ay would be about $100 per lamp per year, based on 4000 lamp-hours; by adding a yearly sum for a sinking fund the cost is raised to $127.70; deducting for the sinking fund and other items thought not necessary to consider, brings the cost down to about $110.

The "Big Store" Plant in New York City. Elec. Eng., May 6.—An illustrated description of the electrical plant in the Siegel-Cooper Company's building.

Twenty-eighth Street Station, New York City. Elec. Eng., May 6.—An illustrated description of this new station of the United Electric Light & Power Company.

ELECTRO-PHYSICS AND MAGNETISM.

Röntgen Rays. Lond. *Elec.*, April 24.—In a brief communication by Dr. Lodge he states that it is a mistake to suppose that the action of the rays on a sensitive film is dependent on the glass backing, as a ferrotype plate is about as rapid as a glass plate; he also states that extra thick filaments on glass are much better than thin ones. Messrs. Phillips, Mance and Moore, in a brief communication, state that with a Jackson focus tube it is possible to pass through two distinct conditions; starting with a two-inch spark and a fairly low vacuum, the tube becomes generally luminous, while flickering green patches appear on the glass; a fluorescent screen glowed brightly, but the shadows of the bones of a hand were not strongly marked; the spark length was then increased, which increased the brilliancy of the screen and the shadows grew fainter until a point was reached when there was scarcely any trace of the hand on the screen; the anode became redhot, the screen fluoresced vigorously and practically no trace of the bones could be seen; on increasing the spark further the whole appearance of the tube changed instantly, a vivid green mist filled the interior and all patches disappeared, the screen became brighter and deep shadows of the bones made their appearance. It seems that under the first condition rays were produced which had the property of passing through bones, while under the second conditions the X-rays appeared stronger and the bones appeared opaque, the tube being then in a good condition for photographs; it appears that a critical vacuum, together with a definite spark-length, is required for the best effect; a certain condition of the glass may also be necessary. Mr. Swinton, from numerous experiments, obtained conclusive evidence that by means of a fluorescent screen, thickly coated with potassium platino-cyanide and

gum, placed behind celluloid photographic film, the exposure is greatly reduced; the chief objection lies in the fact it is very difficult to avoid granular results, and the material should therefore be finely pulverized; considerably better results were obtained with tungstate of calcium, with which sharp and fully exposed negatives of the hand are obtained in 5 to 10 seconds with a moderately excited tube, requiring ordinarily one or two minutes. In another experiment he introduced fluorescent substances into the sensitive emulsion before it was applied to the plate; although the results were not very satisfactory so far, owing to the granular character of the material, it undoubtedly increased the sensitiveness; introducing the fluorescent material into the film does not appear to affect the sharpness, nor does the application of a fluorescent screen behind the film, provided it is in close proximity and the surface is even.

Röntgen Rays. HURMUZESCU and BENOIST. *L'Elec.*, April 25; an abstract of a French Physical Society paper.—Experiments were made with an electroscope covered with a metallic cage, care being taken that all external influences are prevented from acting on it; there is a small window across which various metals to be examined were placed and through which the rays were passed. The leaves always returned to zero; the duration of the discharge is the same for all equal charges and also for those of opposite sign; the different results obtained by Righi, it is thought, were due to external influences; they use this as a method for measuring the intensity of X-rays; the diminution of the deflection was found to be approximately proportional to the time, and for the same initial deflection the duration of the discharge is inversely proportional to the intensity of the rays; the law of the inverse square for different distances was verified up to a distance of 60 centimetres, measured from the wall of the tube opposite the cathode; beyond this distance the absorption of the air is appreciable. They measured the coefficient of absorption of a large number of substances and found that it diminished with the thickness, which leads them to believe that the rays are not homogeneous.

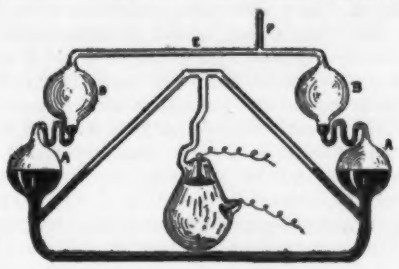
Best Conditions for Using Röntgen Rays. SALVIONI. Lond. *Elec. Rev.*, April 24; a translation from an Italian paper, read Feb. 22; brief abstracts from it have been noticed before in the *Digest*.—For obtaining distinct shadows the sources should be reduced to as small a spot as possible, otherwise the objects must be held too close to the screen or plate, which is not always possible. The X-rays emanate from the region of the tube where the cathode rays excite fluorescence, a fact which he considers well established; by the use of magnets the cathode rays may be concentrated at one point, and are best applied when the cathode is a spherical cap; but there is a simpler and more convenient method of obtaining the same result which he found by chance; when the tube was touched with a hand its luminous appearance varied in an extraordinary manner; he found that instead of the hand a very narrow strip of tinfoil in communication with the cathode may be used, or even a small metallic point in communication with the earth or the cathode; by this method very intense fluorescence, limited to about 1 sq cm, may be produced at a point opposite to that which is touched; the "sensitive section" of the tube, where the point should be placed, is at a distance from the cathode almost equal to the radius of curvature of that cathode; the phenomena may be explained by assuming that the tube is positively electrified where the effective zone is formed, and that the rays capable of exciting fluorescence and X-rays are attracted toward one part of the tube when the opposite part is discharged by the point communicating with the earth or the cathode; "in accordance with this idea it is a question of matter projected from the tube which will be positively electrified."

Determining the Velocity of Röntgen Rays. MURAS. Lond. *Elec. Rev.*, April 24.—A short communication stating that as Jackson has obtained shadows 20 feet from the bulb and Tesla at 40 feet, this would appear to be sufficient to enable a direct determination of the velocity of the rays in air to be made by a modification of Fizeau's method of determining the velocity of light. As the loss by reflection is too great, two 2-toothed wheels rotating synchronously should be used, one near the bulb and the other near the screen or plate; the necessary speed, if the wheels are 20 feet apart, would not exceed that obtained from a steam turbine; the result would probably indicate the nature of the rays; "if the velocity found were that of light, the conclusions would be obvious"; a lower velocity would indicate that the rays are radiant matter, and a higher one than that of light would indicate longitudinal vibration; check experiments, in which the rays pass near but not between the teeth, would be necessary to show whether they were deflected by the proximity of the rotating fields.

Effect of X-Rays on the Contact of Electricity of Metals. MURRAY. Lond. *Elec.*, April 24; an abstract of a Royal Society paper.—His conclusions are that the influence of the rays on the zinc and tinfoil plates does not cause any direct or sudden change in their contact potential, but that the air through which the rays pass is temporarily converted into an electrolyte, and when in this condition forms a connection between the plates which has the same properties as a drop of acidulated water, namely, it rapidly reduces the potential between the opposing surfaces of the plates to zero, and may even reverse it to a small extent.

X-Ray Focus Tubes. WOOD. *Phil. Mag.*, April.—A form of horizontal focus tube in which the cathode is concave and is swung from the end of a rod at the middle of the tube, so that by rotating the tube the rays may be focused on different parts of it.

Duplex Mercurial Air Pump. WOOD. *Phil. Mag.*, April.—An illustrated description of a form of pump which can be made on a very small scale and attached permanently to a Röntgen tube; by this means any trace of gas that makes its appearance can be pumped out by rocking the apparatus by hand; the action is rapid, as one bulb exhausts while the other fills; the device is shown in the accompanying illustration; the



apparatus is first connected with a good mercury pump and exhausted as completely as possible, after which the branch tube is sealed off; the vacuum can then be made as perfect as is possible with any mercury pump, by rocking with the hand; the pump is a very convenient lecture-room apparatus for showing the character of the discharge at different pressures; the air pumped out can, by tilting the apparatus, be made to pass back into the bulb.

A Crookes Apparatus. PFLAUM. *Wied. Ann.*, No. 3, page 443; translated in the Lond. *Elec.*, April 24.—In a certain form of Crookes' tube a certain phenomena occurs; in duplicating this tube the behavior was found to be quite different; in the present paper this difference is described.

Variation Rates of Periodic Phenomena. MURAS. Lond. *Elec. Rev.*, April 24.—A table showing on a uniform scale the relations of the different kinds of vibrations now known; beginning with one vibration per second, each octave (containing double the number of vibrations) is given up to 53 octaves, with a column showing what vibrations have been observed with rates approximating to those given; another column starts in the other direction, beginning with a pendulum beating seconds and running down to 17 lower octaves. These 68 octaves cover the whole range of periodic phenomena from the extreme ultra-violet light to the daily meridian passage of the sun; nearest the unit rate is the pendulum beating seconds; at some distance above there are the sound vibrations extending over about 10 octaves, of which about seven are used in music; these overlap the rates of oscillation of electric discharges in bodies of ordinary dimensions, covering observed data of over 24 octaves; these have been obtained only intermittently; the highest rates obtained continuously are from Prof. Ewing's 140-pole alternator and a Parsons steam turbine, and by Tesla, who works at about 10,000; above these there is a gap of 11 octaves where nothing has been observed: this is followed by heat and light vibrations, only one octave of which is visible to the eye; no vibrations are known having a higher frequency than those in the table, namely, about 10 to the 16th power, "unless the Röntgen rays prove to be such."

Refractive Index and Reflective Power of Water and Alcohol for Electric Waves. COLE. *Ann. d. Physik u. Chemie*, Vol. 57.—An article of some length describing experiments made with his method, from the results of which the following conclusions are drawn: for waves of 300 to 600 cm length, the refractive index for water was 8.95 and for alcohol 5.20, which is in good agreement with the figures obtained by other observers; with waves of 5-cm length the two Fresnal formulas give the same value of the refractive index from the observed reflective power; for water it was 8.8 and for alcohol 3.2; for alcohol the refractive index for long waves is appreciably greater than for short ones. He also shows that such short waves, 5 centimetres long, pass only with great difficulty through even very thin layers of water of 0.04 centimetre, although long electric waves readily pass through the water and both traverse with ease wood, paper, rubber and many other opaque materials; he also shows that reflection is total from metal when the oscillations are at right angles to the plane of incidence and only partial when they are parallel to this plane.

Change of Resistance Due to Electric Rays. ASCHKINASS. *Wied. Ann.*, No. 3, page 408; translated in the Lond. *Elec.*, April 24.—He describes results which show that the changes of the resistance of tinfoil gratings are due to occurrences at the cuts of the gratings and are therefore identical with the phenomenon first observed by Branly.

Discharge Phenomena in Rarefied Metallic Vapors. WIEDEMANN and SCHMIDT. *Wied. Ann.*, Vol. 57, page 454; translated in Lond. *Elec.*, April 24.—The vapors were examined by placing them in a sealed bulb, which was then placed between two electrified external screens. Their conclusions are that in a heated conducting glass bulb, rarefied metallic vapors may be made to glow by oscillating discharges; in metallic vapors the typical discharge phenomena occur, even in monatomic ones; the color and spectrum of the first and third glow-light strata and of the positive light are essentially different.

Behavior of Argon and Helium When Submitted to the Electric Discharge. Collie and Ramsey. Lond. *Elec.*, April 24; abstract of a Royal Society paper.—They give the results of experiments made to measure the distance through which the sparks will pass through these elements at atmospheric pressure, as contrasted with that for other gases; also the pressure at which the spark discharge changes into a ribbon-like discharge.

Lag and Lead. Harrison. Lond. *Lightning*, April 23.—He discusses the subject of lag and lead with special reference to the suggestion made by Mordey (see *Digest*, May 2, under "Regulation of Pressure") that condensers really produce a large lag and not a small lead. He argues that a current is always in phase with the E. M. F. producing it; if a coil has self-induction the lines of force produced will set up an opposing E. M. F. in it, and the resulting E. M. F. is, therefore, made up of two parts, which differ in phase, "but the actual E. M. F. producing the current—that is, the resultant of the two components—is always in phase with the current"; he thinks it is mixing up things to consider the E. M. F. generally referred to, as the one component which is thought to be the most important, while all the others are omitted. The same is true of the condenser, the current in the leading-in wires being subject to two E. M. Fs., that given by the mains and that due to the charging of the condenser, which differ in phase with each other and with that of their general resultant E. M. F.; but the current is in exact phase with the E. M. F. producing it; both the E. M. Fs. affect the conductor simultaneously, and the cause and effect are, therefore, simultaneous, neither preceding the other. He thinks the difficulties of Mr. Mordey and others arise from an attempt to account for the whole of the effect by a part only of the cause.

Photograph of an Incandescent Lamp Filament. Cassells. Lond. *Elec.*, April 24.—An illustration of a photograph of a looped filament taken in such a position that the image of the filament overlaps itself in parts; the idea was to find whether solids, which at ordinary temperatures are opaque, become transparent by increasing the temperature; the filament was photographed by its own light; where the filament crosses itself a brighter light is given out, which would tend to show that the carbon becomes a transmitter of light when incandescent, the light from the rear portion penetrating that of the nearer part.

Fundamental Magnetic Units. Allen. Lond. *Elec.*, April 24. He states that it is possible to avoid the assumption made tacitly or otherwise, of magnetic fluids covering the ends of the magnets, by defining the unit magnet and the unit magnetic field without introducing the idea of a magnetic pole as a temporary expedient; his definitions are based on laws determined directly with the torsion balance, the bifilar, the vibration, or the deflection magnetometer. The first law is that in a uniform field the torque of a suspended magnet is proportional to the magnetic moment of that magnet, the field intensity and the sine of the angle between the axes of the magnet and the direction of the field; the second law is that when one magnet is placed "broadside on" to another, the distance being great as compared with their lengths, the maximum torque acting on the second is proportional to the magnetic moment of each magnet and inversely proportional to the cube of the distance between the centres.

The Magnetic Field of a Cylindrical Coil. Everett. *Phil. Mag.*, April.—A reprint of a short Physical Society paper of a mathematical character.

The X-Rays. Trowbridge. *Pop. Sc. Mo.*, April; a general article on the subject. Among other things he states that glass vessels seem to be more practical than any composite form in which aluminum windows are used; the exhaustion should be pushed to a high degree and a high voltage should be used; he describes some experiments to see whether the rays are refracted, using a double convex and a double concave lens of wood, but obtained no refraction; although these rays have some different properties than the cathode rays, he suggests that they may still be cathode rays, claiming that the want of refractive power and magnetic action have not been fully established; cathode rays cannot be formed in a perfect vacuum; it is useless to attempt to make photographs in any reasonable time from tubes which do not show a strongly-marked cathode beam or from tubes which, on reversing the current, do not show a marked difference between the light at the cathode and at the anode; he believes the molecular view of the phenomenon is at first sight more tangible than the longitudinal wave theory; it is possible that the impact of the molecules on the inside of the glass vessel may serve to start ripples in the ether which are propagated with the velocity of light; he refers to an experiment of Lenard, which showed that the cathode beam can be passed through a vacuum, although no cathode beam could be generated in it; he considers this the most interesting of Lenard's experiments; he thinks that the property of X-rays to discharge bodies which have been charged leads one closer to the wave theory than to the molecular theory.

Röntgen Rays not Present in Sunlight. Lea. *Am. Jour. of Sc.*, May.—A short article describing a number of experiments which he made with sunlight, all of which gave negative results; according to Röntgen's views these rays ought to be found among the many forms of radiant energy received from the sun; he shows among other things that wood is translucent to the ordinary light. Henry stated that phosphorescent bodies also emit X-rays; experiments made by the present writer gave negative results.

Anode Radiations. Jones. *Jour. of El'ty*, March.—An illustrated article of some length on Röntgen rays, describing experiments, from which he draws the following conclusions: That the X-rays do not emanate from the glass nor from the cathode, but that a certain number emanate from the anode irrespective of the position of the cathode, and the number and intensity of these seem to increase with the vacuum and voltage; they also emanate from a metal plate within the tube which is not connected with either pole; they are produced in the largest number, and with the greatest intensity from the anode when the cathode rays are focused on the anode terminal; when X-rays are focused on the cathode they are reflected therefrom; Prof. Sanford considers these deductions justified with the exception of the last.

Cathode Radiation. Sanford. *Jour. of El'ty*, March.—A short illustrated article, chiefly of a historical nature, leading up to the subject of Röntgen rays.

Recent Work on the X-Rays. Pop. Sc. Mo., May.—A brief summary taken from articles published within the last few months, most of which have been noticed in the *Digest*. An explanation is given of the X-rays, offered by Mr. Gifford; he compares the Crookes tube with a vibrating tuning fork, which would set a violin string of the same note in vibration with it, as also of the octave and the fifth of the octave, besides a number of overtones of rapidly decreasing wave-length; the waves of long period from a Crookes tube would pass through wood, paper, etc., without much resistance, but would be absorbed or reflected by the denser metals; but if objects capable of taking up their vibrations lay in the path of these longs rays they would be set into vibration like violin strings and might, in the same way, produce overtones which did not before exist, and this may include waves of such short lengths to cause the objects to become luminous; if so, the light waves in question, although they affect the sensitive plate, have, nevertheless, not passed through and could never pass through the obstacles easily traversed by the electric waves which gave them origin.

Röntgen Rays. Chandlee. *Southern Journal of Homœopathy*, April.—An article on the use of Röntgen rays in diagnosis of pregnancy, which includes three good plates showing two four-months' fœtus, a six-months' fœtus and another in the uterus, taken by H. S. Hering at the John's Hopkins University. The article states that the cartilage entering into the skeletal formation of a four-months' fœtus can be differentiated by these rays, and that a perfection of the apparatus is all that is necessary for the satisfactory diagnosis of pregnancy by this method; he believes that these rays will play an important part in such diagnosis, prognosis and treatment; an early recognition of the sex is thereby possible.

Elec. Power for April contains an illustrated article prepared from Mr. Osterberg's lecture of March 19.

The Character and Effects of Cathode Rays. Wright. *Forum*, April.—A brief article giving a history of the discovery and development of cathode and Röntgen rays.

Temperature of the Carbons of the Arc. Wilson and Gray. *Am. Jour. of Sc.*, May.—A brief abstract of a Royal Society paper giving the results of measurements; the temperature of the positive pole was found to be "3600 degrees abs. or 3300 degrees C.," which agrees very closely with the approximate estimate of Violle, namely, 3500; the method used was to balance the radiation from a platinum strip against that of the carbon of the arc; taking 3300 degrees as that of the positive carbon, that of the negative was found to be 2400; no estimate is attempted of the temperature of the arc itself.

ELECTRO-CHEMISTRY AND BATTERIES.

Experiments with Air Batteries. Zettel. *Zeit. f. Electrochem.*, April 5.—He describes some experiments made at the suggestion of Prof. Ostwald, in order to find whether the oxygen of the air can be used in the "battery of the future," with the aid of "katalysators"; the experiments, especially with the katalysators, did not give any positive results, but some interesting observations were made; in the first test he used pure oxygen and an electrode of platinum foil in sulphuric acid; the choice of the other electrode involved difficulties; it was necessary to prevent the platinum from generating hydrogen, and a metal as nearly as possible like platinum should therefore be used; amalgamated lead and mercury were used, but a superficial coating of sulphates was produced; he therefore used copper; with a polished platinum electrode only weak currents were produced, but after it was platinized (presumably with platinum-black or spongy platinum) he obtained, with a resistance of 20 ohms in circuit, a constant current up to 5 milliamperes, the area of the platinum being 20 square centimetres; with a number of different agents, with which a katalytic action was expected, it was not obtained; that the oxygen played an essential part was shown by its consumption; in using air a current of 4 milliamperes was obtained, the electrodes being partly in the air and partly in the liquid; some results of the measurements are given, showing that there was no katalytic action. With a platinized electrode the curious observation was made that between 200 and 300 ohms resistance in the circuit there was an unexpected sudden increase in the current and voltage; this same phenomena was noticed in

most of his tests; by using oxygen instead of air this result was not obtained; he considers it best to use for a negative electrode a metal which will just produce a slight generation of hydrogen on the platinum electrode, and for this purpose thallium amalgam was found suitable; with an increasing resistance there was a rapid increase in voltage and the current, which at first remained nearly constant, then diminished slowly, no sudden changes being noticed as also no difference for a decrease as compared with an increase in the resistance. At higher temperatures stronger currents were obtained; he also used an electrode of silver gauze covered with spongy silver, but it was found to be much less powerful than platinum black; with a low external resistance there was little difference between platinized silver and platinum, the former being even the stronger.

Electrolytic Solution of Carbon. VOGEL. *Zeit. f. Electrochem.*, April 20.—An unfavorable criticism of the recent article of Coehn (*Digest*, April 11). In the discussion of the transformation of the chemical energy of coal into electrical energy, errors are likely to arise which, with a thorough knowledge of the subject would not be made; as a true free ion, carbon has never yet been obtained, nor has Coehn succeeded in obtaining this from a solution in water; that carbon may be an inherent part of ions has been known for some time, and he believes that carbon was only a part of the ion which Coehn claims to have found, as there was always hydrogen and oxygen produced besides carbon; it was also known that carbon deposits *in* the kation and not as Coehn says, *as* the kation. It is to be regreted that Coehn did not publish the analysis of the deposit formed on the cathode which Vogel thinks is a reaction product of the carbon anode; it is also to be regretted that an analysis was not made of the substance in the reddish brown solution. He gives a list of references to a controversy between Bartoli, Papasogli and Millot; the two former have obtained electrical energy from carbon in solution in water, but not with the same E. M. F. as that obtained by Coehn, who used a formed accumulator plate for the other electrode. In conclusion he enumerates the results obtained by Coehn in a different form, as follows: no one has yet succeeded in dissolving the carbon by an electrolytic process; carbon from a solution of carbon compounds has never yet been deposited as a kation but only as an inherent part of a kation; the construction of a cell in which the plate which is consumed is made of carbon, was effected by Bartoli and Papasogli and improved by Coehn.

Output of Galvanic Cells. ZACHARIAS. *Zeit. f. Electrochem.*, April 20.—He shows the importance of tests of long duration in examining cells of the Laclanche order, and refers to those which he made covering a period of nine months, giving the results briefly, which show among other things that the voltage alone cannot be taken as an indication of the value of a cell, and that the current on short circuit is a more reliable indication; the value of tests of short duration is very slight; they should extend over a period of one to two years. He discusses briefly the results of tests made with the aid of an electric clock and covering a long period. In conclusion he refers to a test of a Lalande cell for lighting purposes which has been generating daily about 6 ampere-hours for a period of 4 years; it is used for one to two incandescent lamps of 12 cp and delivers about 2190 ampere-hours per year; the cost per ampere-hour is less than 1.25 cents; in the assumption that the cell will last three years, the cost per ampere-hour is 1.33 cents. From recent researches he is convinced that it is possible to construct cells which will deliver a strong current continuously and which have a rapid polarization.

Depositing Metals with Alternating Currents. ROESING. *Zeit. f. Electrochem.*, April 5.—In using the ordinary alternating current the efficiency in the deposition of metals is very poor; to better this efficiency he suggested using an alternating current which was not symmetrical; he therefore used a direct current with a commutator arranged so that the reverse current lasted for a much shorter time than the direct, the time for the reversed current being made such that complete polarization took place but that none of the metal was re-dissolved by it; when these conditions were fulfilled, a dense, even deposit was formed, without an appreciable loss in the efficiency. Numerical results of a number of tests are given.

Aluminum Works at Foyers. Lond. *Elec. Eng.*, April 24.—The beginning of an illustrated description of the works which are being constructed at the falls of Foyers, at which aluminum is to be produced by the Herault process. A carbon-lined iron vessel is used for obtaining the aluminum pure; the raw material is bauxite, which is heated with caustic soda and the aluminate of soda extracted with water, from which the alumina is precipitated by carbonic acid.

Electrolysis of Chlorides. ANDREOLI. *L'Elec.*, April 25.—The first part of an article giving a summary of the progress during the last 10 years.

Calculations of the Conductivity of Mixtures of Electrolytes. MACGREGOR. *Phil. Mag.*, April.—A paper showing how such calculations may be made with more or less accuracy.

Extracting Gold Ores. GROSVENOR. *Eng. & Min. Jour.*, May 2.—An illustrated description of the Bailey process and apparatus which has been in experimental use at Cripple Creek and is said to have proved to be very successful. The pulverized ores are subjected to four agents simultaneously, gravity, solution, amalgamation and electrolysis; a cyanide solution is used and is partially decomposed by the current potassium hydrate forming at the cathode and serving to clean the gold and facilitate amalgamation, while the oxygen liberated assists in breaking down the tellurides or sulphides; the electrical action is said to make the amalgamation instantaneous and also to prevent the mercury from retaining a minutely spheroidal condition; the present plant has been handling about 25 tons a day, at a cost of $1.50 a ton, with coal costing $5.50.

Nickel Plating of Wood. Eng. & Min. Jour., April 18.—Several receipts for depositing the first coating of metal; one of these, the Langbein dry process, consists in quickly pouring over the object a collodion solution of potassium iodide diluted with an equal volume of ether-alcohol and when just about to set, the object is placed in a weak solution of silver nitrate in the dark; when a yellow color appears, the article is rinsed, exposed to sunlight and covered with copper. Wooden articles for surgical instruments may be treated by immersion in an etherial solution of paraffin or wax, after which it is dusted with graphite or bronze powder.

UNITS, MEASUREMENTS AND INSTRUMENTS.

Determining the Angle of Lag. CLARKE. *Phil. Mag.*, April.—A brief description of an instrument devised by him for making this measurement. It is based on the well-known Lissajous figures; the dynamo current is passed through a loop of wire clamped at one end and carrying a small mirror at the other, which is free to vibrate when suspended between the poles of a magnet, so that with every change of direction of the current they tend to rotate in one or the other direction; a beam of light will therefore be drawn out into a line; this beam falls on a second mirror operated by another current, and having a plane of vibration perpendicular to that of the first; in the resulting figure produced by the beam, the amount by which one mirror leads the other can be determined; the measurement is made with a telescope having two scales perpendicular to each other; when the ellipse formed is a straight line, the currents are in phase, while if it becomes a circle the currents are in quadrature; the amount of self-induction in the apparatus is inappreciable, and the loop keeps well in time with the current, as the vibrations are forced; he claims thereby to have overcome the two great difficulties in the usual forms of this apparatus—namely, the self-induction and the inability of the vibrating wires to follow a change of the period.

Method of Measuring the Frequency. MEYER. *Elec. Tech.*, March 14.—An article on magnetic hysteresis, showing how hysteresis is calculated and including a description of an instrument in which the heating of a wire due to hysteresis is used as a means of measuring the frequency of oscillating currents; a steel wire fastened at one end passes up through a solenoid, over a pulley, back through the solenoid again, and thence around a drum with a pointer, the end being attached to a spring; on passing an oscillating current through the solenoid the wire is heated due to hysteresis; knowing the constance of the wire the frequency can be calculated; the formula is given; he thinks that the measurements may be made with considerable accuracy; the energy lost in the apparatus is small.

Electric Thermometer for Low Temperatnres. WITKOWSKI. *Phil. Mag.*, April.—A brief illustrated description of a form of thermometer which he found very useful for low temperature work on account of its sensibility and quickness; it is based on the variation of the electric resistance of wires due to temperature changes.

Determination of High Temperatures with the Meldometer. RAMSAY and EUMORFOPOULOS. *Phil. Mag.*, April.—A reprint in full of a Physical Society paper abstracted in the *Digest*, March 21.

Pyrometry and Thermo-Electric Formulas. HOLMAN. *Proc. of the Amer. Acad.*, Vol. 31.—Several papers on various allied subjects; in one of them, on the calibration of the Le Chatelier thermo-electric pyrometer, he described a new method for simplifying the calibration by using a logarithmic instead of a direct plot; it requires to be calibrated at only two known temperatures instead of at several, as formerly; the cold junction is kept at the temperature of the room and measured by a mercury thermometer and the other junction is exposed successively to two known temperatures, preferably boiling sulphur and melting copper, or for high temperatures, melting platinum. In another paper on thermo-electric interpolation formulas, published also in the *Tech. Quart.* for December, after discussing the several well-known formulas for the thermo E. M. F. as a function of the temperature, he gives two new formulas and the results of tests showing their relative merits; one of the formulas which he gives is exponential; his conclusions are that for interpolations over long ranges and for extrapolation above the observation limits, the exponential form is decidedly preferable. In another paper on the melting points of aluminum, silver, gold, copper and platinum he describes in detail the methods and apparatus, using the Le Chatelier pyrometer and the exponential formula discussed in the above paper.

TELEGRAPHY, TELEPHONY AND SIGNALS.

Efficiency of Translators. WIETLESBACH. *Jour. Teleg.*, Feb. 25 and March 25.—There exists a difference of opinion as to the efficiency of telegraph translators, some authors giving it as 30 to 40 per cent. and others as 90 per cent.; as this auxiliary apparatus can often be of great service he carried out a series of careful tests to determine it; the apparatus is of use for a number of purposes, among others to prevent or diminish disturbances due to other lines. He describes these different forms and

gives the results of experiments made with them, concluding that their efficiency can probably not be increased beyond 90 per cent. for mean frequencies.

Disturbances in Telephone Lines. See abstract of article by Wietlisbach, under Traction.

Telephony and Telegraphy. Anizan. Lond. *Elec. Rev.*, April 24; the first part of a translation of an article from *L'Eclairage Elec.*—He discusses the possibility of utilizing the secondary telegraph lines for telephonic conversations, a question which, he says, is not as simple as it appears at first sight; he discusses alternate and simultaneous communications, and among the latter describes the applications of the Van Rysselberghe, the Picard and the Cailho systems.

Telephone Exchanges and Their Working.—The London journals, April 24, contain the discussion of the Institute paper by Mr. Sinclair (see *Digest*, May 2); it is discussed editorially in the Lond. *Elec. Rev.* It seems from the discussion that the general opinion was in favor of the vertical as distinguished from the horizontal switchboard.

Telephone Statistics for Tokyo, Japan. Elec. Friend (Japan), March.—There are 18 telegraph stations in Tokyo City, including one main office; the total number of messages sent and received in that city for the month of January, 1896, in Japanese characters, was 13,316; for January, 1891, it was 2223, showing a sixfold increase in the five years.

Telephony in Austria. Elek. Tech., March 31.—A long table giving a list of the Government telephone stations with the number of subscribers, up to the end of last year.

Telephone Central Station in Paris. De La Touanne. *Bul. Soc. Int. des Elec.*, March.—A long illustrated description of the Gutenberg Street station in Paris.

Motor Starting Box.

The C. & C. Electric Company, New York, is introducing a motor starting box which in addition to the usual functions of such a device, possesses some features of special merit.

Motor Starting Box.

With its use the motor may be started under full load and gradually and smoothly brought up to full speed. The box is fitted with a double-pole knife-edge switch for opening and closing the supply circuit; also with a double-pole fusible circuit-breaker for interrupting the service in case the motor is overloaded or otherwise endangered, such as might result from a hot bearing.

A magnetic circuit-breaker is provided as part of the equipment, and is adjustable for automatic action at any given load.

The contact lever is fitted with a spring motion which automatically throws the lever into the position of maximum resistance, either when the service is interrupted or when the motor is overloaded. The sliding contact piece is of carbon and copper combined, thus insuring ample carrying capacity, and freedom from burned contacts and other evil effects.

The automatic circuit-breaker is provided with an auxiliary device which may be so adjusted that the device will act for opening the circuit and throwing the lever back in the event of the interruption of the service, only in cases where it is not desirable to have the motor shut down for momentary overloads.

The whole equipment is of handsome appearance, compact and fireproof, all the parts being mounted on a single marbleized slate slab.

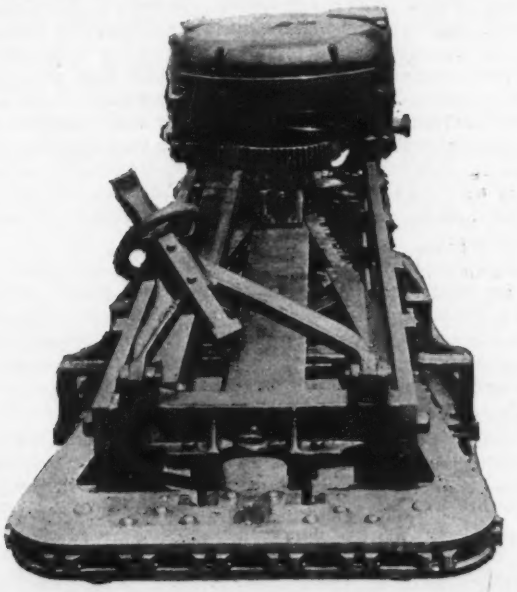
The Electrical Exposition.

The Electrical Exposition which was opened in New York Monday, May 4, in now in full operation every day and night, and will continue all through the month of May. Many interesting things are to be seen. The ladies take a great fancy to the electric cooking apparatus and electric hair-curlers, and the crowd in general delight in listening to Niagara's roar communicated to them by way of the telephone.

A Portable Mining Plant.

A novel departure has recently been adopted by the power and mining department of the General Electric Company in its campaign to introduce electric mining apparatus for the operation of coal mines. The question of coal cutting by machinery, instead of by hand, is a simple one of dollars and cents to be saved by adopting mechanical methods, but conviction was difficult, as the experience of mine operators with electrically-driven machinery has been limited, and they are naturally skeptical.

Box Car on the Siding Near the Tipple.

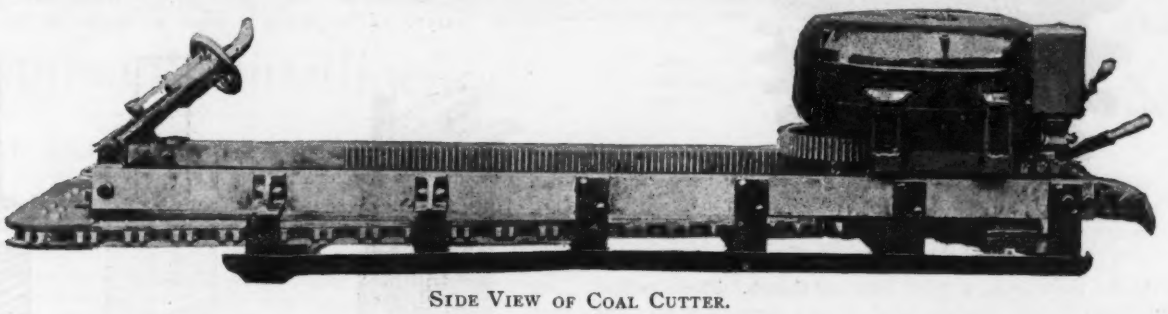


Front View of Coal Cutter.

Something more conclusive than simple argument on experience elsewhere is necessary—as, for instance, a careful test under actual working conditions. But such a test would require a complete installation, and

neither mine operator nor manufacturer has cared to undertake the installation of a temporary plant, necessitating considerable outlay, with only a chance of eventual sale. This fact has consequently hitherto militated against the experiment.

To enable the operator to judge from actual observation of the merits of machine mining as compared with pick mining in his own coal, the General Electric Company has devised a complete and compact portable power plant, susceptible of installation near the mine mouth. It includes all the necessary electrical apparatus, and the operator is called upon to furnish nothing more than the water and fuel.



SIDE VIEW OF COAL CUTTER.

The generating plant occupies the interior of a box car, 40 feet 3 inches long, 8 feet wide and about 9 feet high, and consists of a specially designed water-tube boiler of a capacity of 40 horse-power at 100 pounds pressure, furnishing steam to a high-speed automatic engine, running at 300 revolutions and exhausting into the boiler flue.

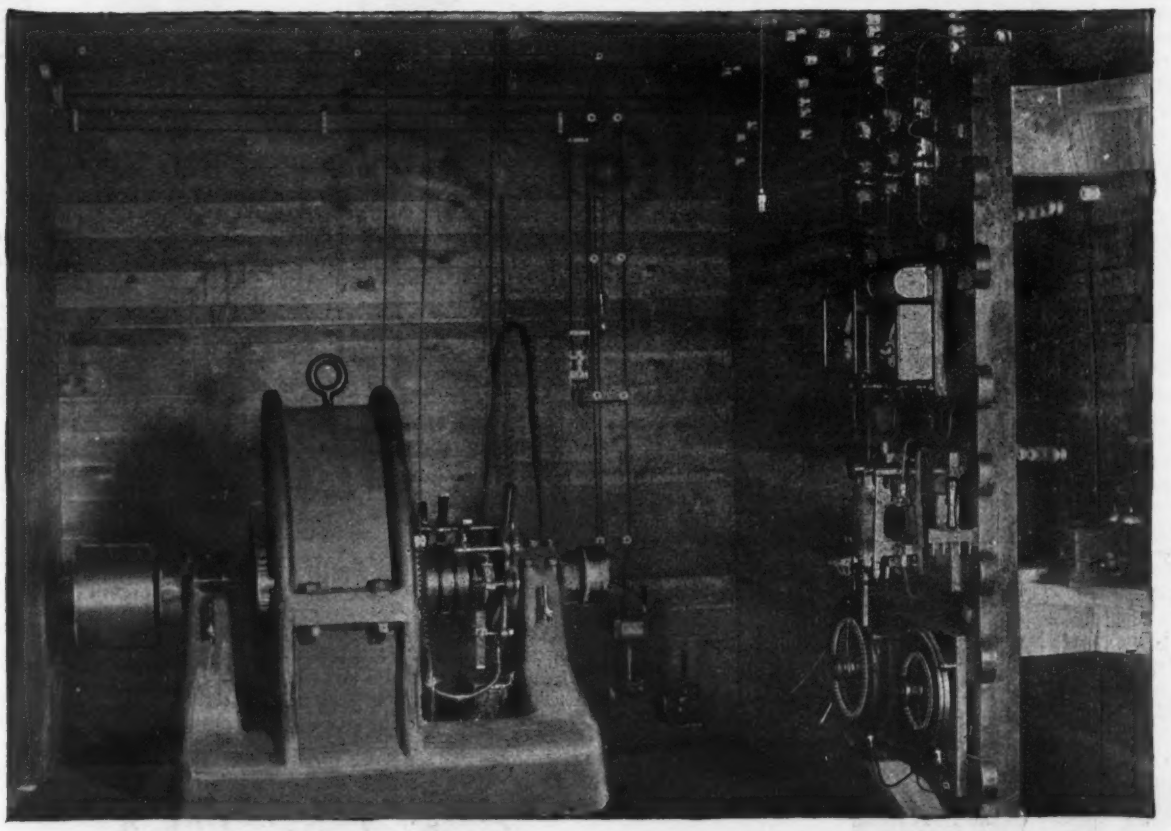
The electric generator is a three-phase machine of 75-kw or 100-hp capacity, wound for 550 volts, and running at 900 revolutions. It is belt-driven from the engine. A small bi-polar generator serves as an exciter. Although in this case it only runs one coal cutter, it has sufficient generating capacity to supply current to a plant of five or more coal cutters, the capacity, of course, depending upon the hardness of the material to be cut.

To the right of the generator is a skeleton switchboard, equipped with the necessary switches, rheostats and measuring instruments, etc.

The coal cutter, which forms a part of the plant, is the first known adaptation of the multiphase motor to the coal-cutting machine. This motor is ironclad, and is completely enclosed and protected from moisture and injury. It has neither commutator nor brushes and no moving wires. It stops operation as soon as it has reached the limit of its power, and thus is not exposed to accident in case of overload. Furthermore, it is sparkless, and this fact only needs mention to find full appreciation of its value from mining men.

The cutter itself is a chain machine, making a cut 3 feet wide, 6 feet deep and 4½ inches high in about 3½ minutes. It withdraws in about 10 seconds. The capacity of the motor is 20 horse-power, but the consumption of power under ordinary conditions is between six and seven horse-power.

The portable electrical coal-cutting plant has recently been operating in the mines of the Peerless Coal & Coke Company, at Vivian, W. Va., where the record for machine coal-cutting has been established. The amount of cutting showed the remarkable average of 7.6 runs or cuts per hour. Taking the depth of cut at 5½ feet, the width 36 inches and the thickness of the coal 5 feet, for a period of two weeks, the average weight of coal undercut per hour was not less than 23 tons. At the mines of the Sterling Mining Company, Cannelton, Pa., a contract for several of these coal-cutters was given to the General Electric Company after exhaustive examination of the multiphase system in operation. It was awarded in face of most severe competition, and also in face of the fact that Mr. W. H. Warner, the general manager of that company, had been using for a number of years a mine plant operated by direct-current.



THE GENERATING PLANT INSIDE THE CAR.

Gear Gauges.

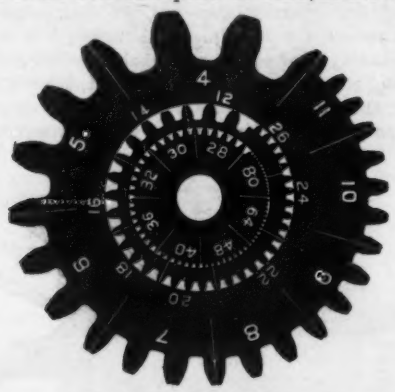
Every machinist will appreciate the necessity of wire, twist drill, sheet metal and other gauges. As gears are made or ordered very frequently and form an important part of most machines, it is obvious that a set of gear gauges that can be readily used would fill a long-felt want. The gauges are designed for many purposes.

A gear cut a certain pitch, if cut correctly, will mesh nicely with the corresponding pitch marked on the gauge. If it does not mesh correctly it will indicate that the gear is spaced wrong or cut to some odd pitch, which for fine pitch is not in general use.

Those who do not cut gears frequently will not know by sight the exact depth a space should be cut. By placing the gauge on the blank to be cut the exact depth and width can easily be scratched on the same. The gauges are very useful to draftsmen for drawing tooth outlines. For this class of work it is advisable to use an extra set cut with teeth a trifle thin

to allow for thickness of pen or pencil used, otherwise the teeth will be marked thicker than the gauge.

Manufacturers designing new movements will find it quite helpful to have gear teeth of all available pitch at hand, as the exact size can be



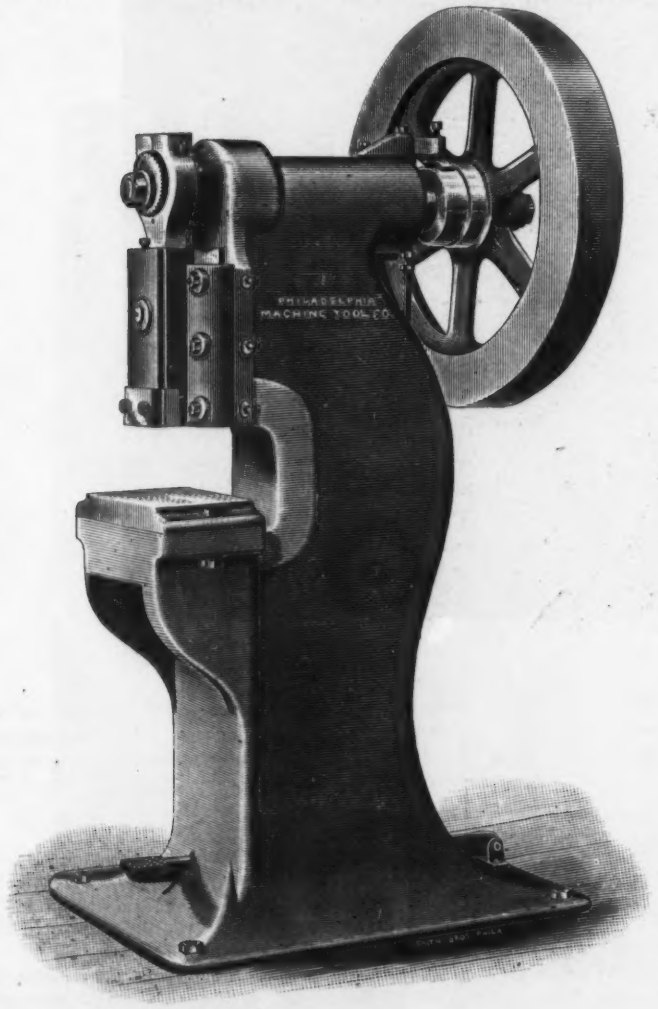
Gear Gauge.

comprehended better than from a mere print or sketch. These gauges are being introduced by the Boston Gear Works, Boston, Mass. The accompanying illustration is one half size.

Punching and Stamping Press.

J. J. McCabe, of Philadelphia, has at the New York Exposition some fine samples of punch presses built by the Philadelphia Machine Tool Company, which show some of the latest improvements on this labor-saving tool. The machine has few parts, and affords the most direct transmission possible of the power from the fly-wheel to the punch. It is well proportioned as to its parts and the distribution of metal in them.

The body of the machine is of the deep box pattern and of a superior grade of cast iron. The fly-wheel is mounted on a crucible steel crank shaft which it drives by an improved clutch. This crank shaft is one of the features of the machine, as it is of the best material made and is forged



Punching and Stamping Press.

in one solid piece, without collars or eccentrics keyed or even welded on. From the crank-pin to the wrist-pin in the slide the metal is subjected simply to a compressive strain, and therefore is absolutely rigid; and further, there is but one piece, the pitman, with a bronze bushing for adjustment.

New Storage Battery.

The Willard Electric & Battery Company, 33 Sheriff Street, Cleveland, O., manufacturers of the Willard storage battery, claims that its battery is a decided step in advance in storage-battery development. The plate is made from pure rolled lead, the active material being formed by an electro-chemical process. After formation the plate presents a very large surface, one of 7 x 8 inches having a surface of 14 square feet.

The hard-rubber cell in which the positive plate is enclosed (Fig. 1) is corrugated and perforated in such a way as to secure the best circulation of the electrolyte. This is said to be an economical feature of the battery, since all scales of the active material that may be detached are retained in the cell and remain in contact with the central piece, where they still remain as active material. Figs. 2 and 3 show sections of the plate before and after forming.

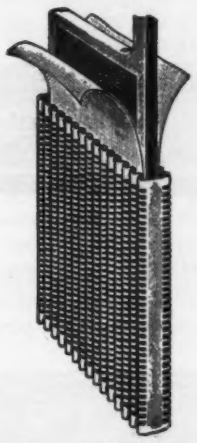


Fig. 1. — Manner of Protecting Plates.

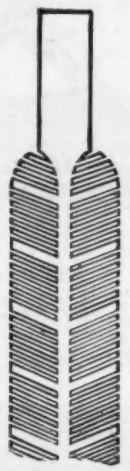


Fig. 2.—Plate Before Forming.

Fig. 3.—After Forming.

The company claims that short circuiting and buckling cannot occur in this battery, nor is there any formation of mud.

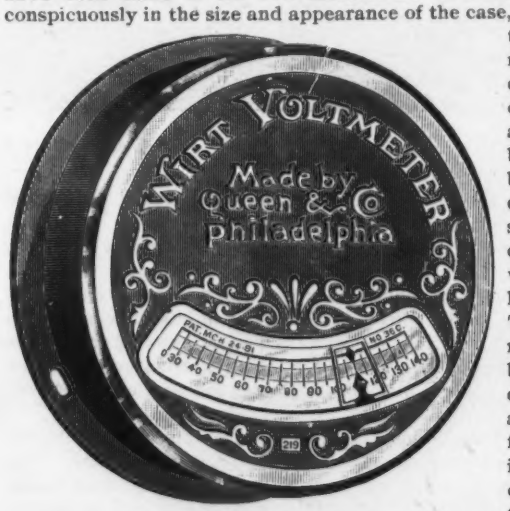
The "Willard" plate it is claimed will withstand a great amount of manipulation and hard usage after formation. The internal resistance of the battery is very low and the voltage remains constant to nearly the full discharge.

The connections of these batteries are so constructed as not to corrode or burn out.

The company makes a specialty of storage batteries for physicians' uses. This class of battery includes an ampere gauge which enables the user to determine at a glance the exact condition of the battery at any time, and ascertain the degree of discharge.

New Switchboard Instruments.

Queen & Co., Philadelphia, announce that they have produced out and are ready to put on the market an improved form of the Wirt switchboard ammeters and voltmeters. In its essential features no alterations have been made in the new instrument. It differs from the old most conspicuously in the size and appearance of the case, which is made entirely of iron and is nine inches in diameter. The lettering on the front is raised and nickel-plated, or bronze on a black background. In addition to this, all instruments are made dead-beat, a feature which much enhances their value. The arrangement making them dead-beat is a form of air-damper and does not at all increase the friction of the moving parts. The other changes are in matters of detail and are the result of a long experience in the manufacture and standardization of electrical instruments.



Voltmeter.

The new instruments will be covered by a guarantee, both as to their accuracy and mechanical construction. They can be furnished of any desired range and for either alternating or direct-current circuits.

NEWS OF THE WEEK

Financial Intelligence.

THE ELECTRICAL STOCK MARKET.

NEW YORK, May 9, 1896.

THE ELECTRICAL STOCKS.—General Electric showed some weakness during the week, closing at figures 1¼ points below those of the previous week. The highest price was 36⅜ and the lowest 33¾. Edison Electric Illuminating, of New York, was stronger, the closing quotations showing an increase of two points. The number of shares that changed hands was 1563.

TELEGRAPHS.—Western Union was practically steady, the fluctuations keeping within a margin of ½. Postal Telegraph declined a fraction on the week's transactions.

ELECTRICAL STOCKS.

	Par.	Bid.	Asked.
Chicago Edison Company	100	120	125
Edison Electric Ill., New York	100	99½	100
" " " Brooklyn	100	100	102½
" " " Boston	100	135	140
" " " Philadelphia	100	137	..
Edison Ore Milling	100	13	15
Electric Storage Co., Philadelphia	100	34¼	34⅞
Electric Storage, pref	100	36	37
General Electric	100	34⅞	35¼
General Electric, pref	100	..	75
Westinghouse Consolidated, com	50	29	30
" " pref	50	52½	53½

BONDS.

Edison Electric Ill., New York	105	103	..
Edison Electric Light of Europe	100	75	85
General Electric Co., deb. 5s	100	206	..

TELEGRAPH AND TELEPHONE.

American Bell Telephone	100	..	206
American District Telegraph	100	38	40
American Telegraph & Cable	100	94	97
Central & South American Telegraph	100	124	127
Commercial Cables	100	150	..
Erie Telephone	100	59	..
New England Telephone	100	..	90
Postal Telegraph-Cable	100	85	87
Western Union Telegraph	100	85⅝	85¾

ELECTRIC TRACTION STOCKS.

Baltimore Traction	25	18¼	18½
Brooklyn Rapid Transit		23⅞	24⅛
Brooklyn Traction	100	..	14
" " pref.	100	46	48
Buffalo St. Ry	100	70	73
Cleveland Electric Ry	100	..	..
Columbus St. Ry	100	44	47
Hestonville	100	50¼	50⅝
" pref.		..	62½
New Orleans Traction	100	15	17
" " pref.	100	60	63
North Shore Traction	100	29	31
" " pref.	100	79	81
Rochester St. Ry	..	20	25
Steinway Ry	..	45	50
Union Railway (Huckleberry)		98	105
Union Traction, rcts $10 pd	..	14½	14¾
West End, Boston	100	70¼	71½
" " pref.	100	92	..
Worcester Traction	100	16½	18
" " pref.	100	87½	89½

BONDS.

Brooklyn Rapid Transit 5s. 1945	100	78	80
Buffalo St. Ry. 1st con. 5s	100	106	..
Cleveland Elec. Ry. 1st mtge 5s	100	100	103
*Columbus St. Ry. 1st 5s	100	95	100
Rochester St. Ry. 1st 5s	100	99½	102
Union Railway (Huckleberry) 1st mtge 5s		102½	105
*Westchester Electric 1st mtge 5s	100	100	102

* With accrued interest.

TRACTIONS.—The general street railway list was inactive, prices declining somewhat on limited trading.

Special Correspondence.

NEW YORK NOTES.

Office of THE ELECTRICAL WORLD,
253 Broadway, NEW YORK, May 11, 1896.

C. S. VAN NUIS has moved his office from 136 Liberty Street to his shop at 43 Cortlandt Street.

W. R. OSTRANDER & CO. have removed from their old stand at 204 Fulton Street to new quarters at 22 Dey Street.

H. C. CUSHING, JR., of Boston, has been appointed special inspector of the Underwriters Tariff Association, New York.

MR. JOHN G. CRANE has purchased the interest of A. V. Forbes in the Telephone Construction Company, 35-37 Frankfort Street.

ON FRIDAY, May 8, Prof. F B. Crocker delivered a lecture on "Troubles in Dynamos and Motors," before the Henry Electrical Club. A large audience was present.

THE SAWYER-MAN ELECTRIC COMPANY has been reorganized by the Board of Directors, and is now prepared to resume the manufacture of the Sawyer-Man incandescent lamp.

THE AMSTERDAM AVENUE extension of the Third Avenue Railway, which extension is operated on the Love underground trolley system, was opened on Monday morning, May 4.

FRANCIS JETE, of the American branch office of F. Hardmuth & Co., of Vienna, Austria, at 60 Liberty Street, has been called to headquarters in Vienna, where his presence is needed. During his absence the firm of Knauth, Nachod & Kuhne will conduct the business.

THE BI-METALLIC ELECTRIC TRANSMISSION COMPANY, New York, has issued a small pamphlet setting forth the special features of its bi-metallic wire for use in telephone, telegraph, light, power and trolley service, including a table giving the weight per mile and strength for various sizes.

THE AMERICAN DISTRICT TELEGRAPH COMPANY is introducing bicycles for the use of its messengers. The experiment is being tried in one section of the city. If it proves successful the wheel will be generally introduced; the messengers have also been fitted out with new Summer uniforms

TO ENLARGE ITS PLANT.—The Electric Arc Light Company reports that the reception accorded its new Pioneer enclosed incandescent arc lamps has been such as to necessitate the enlargement of its plant and removal of its offices from 73 Watts Street to more commodious quarters at 687 and 689 Broadway.

STANLEY & PATTERSON, 32 Frankfort Street, have greatly enlarged their store, and moved their offices to one of the upper floors of the same building. These improvements give them much more room, which was greatly needed, and will enable the firm to handle its increasing business with greater facility.

SALE OF SELLING RIGHTS.—On May 20, 1896, Strong & Ireland, auctioneers, 60 Liberty Street, will sell for Percy L. Klock, assignee of the George L. Colgate Company, at the New York Real Estate salesrooms, 111 Broadway, the selling rights agreement under patent No. 475,482 for the exclusive sale of the swinging ball lighting arresters.

MR. FRANKLIN BROOKS, junior member of the firm of Eugene Munsell & Co., New York, miners and importers of mica, was welcomed home from a 40,000-mile trip through the mica fields in India. The firm imports mica direct from the mines, and Mr. Brooks has completed arrangements whereby they are in a position to supply mica to the electrical trade in larger quantities than heretofore.

THE ELECTRIC SELECTOR & SIGNAL COMPANY has removed its offices and shop to 43 Cortlandt Street. Inventors can find here good men and tools for experimental works, and the company solicits repair work of all kinds. The company, however, continues the manufacture of its railroad selectors; as also the automatic devices for cutting out arc lights, motors and converters from the stations. Mr. P. H. Alexander is in charge of the business.

THE GARVIN MACHINE COMPANY, Spring and Varick Streets, announces that on June 1 it expects to take possession of an entirely new factory, where it will be in a position to serve its patrons more satisfactorily than ever before. The new factory building is eight stories high, 72x160 feet in size and is situated at the northwest corner of Spring and Varick Streets. It will be thoroughly equipped with new and modern machinery, which will be driven by electric power.

THE BRIDGE ELECTRIC POWER PLANT.—At a special meeting of the Bridge trustees last week it was decided that the Bridge would supply its own electric power for the new motor cars. Chief Engineer Martin fixed the cost of the plant at $60,530, and it will be provided as soon as possible. He also estimated that the expense per day of operating the electric cars would be only $106.50, while the bid of the Edison Company called for $196.21, and that of the Brooklyn Heights Company $188.

PHILADELPHIA NOTES.

Branch Office of THE ELECTRICAL WORLD,
927 Chestnut Street,
PHILADELPHIA, Pa., May 10, 1896.

EVANSON & ARMPRIESTER, Philadelphia, have just issued an illustrated catalogue of their switches, switchboards and tablet boards, a copy of which may be obtained by asking for their catalogue D.

MR. CHARLES WIRT, Philadelphia, announces that the resistance of the special alloy of the Wirt brush has been determined in the laboratory of Queen & Co., and has been found to be 49 times as high as copper and more than twice that of platinoid.

THE UNITED STATES TELEPHONE CONSTRUCTION COMPANY, Philadelphia, is now manufacturing six standard styles of M & B. telephones, which they claim do not infringe on the Berliner patents. These types include a double battery phone for trunk lines of 1000 miles, a standard exchange phone for towns, and interior sets for houses, factories and office desks. The telephones are manufactured under the patents of Mr. Bonta.

NEW ENGLAND NOTES.

Branch Office of THE ELECTRICAL WORLD,
Room 91, Hathaway Building, 620 Atlantic Ave.,
BOSTON, MASS., May 10, 1896.

JOHN W. COSDON & CO., 246 Massachusetts Avenue and 293 Hanover Street, Boston, have added an electrical department to their business of sanitary plumbing, ventilating, steam and gas fitting. They will fit out public and private buildings for incandescent lighting, gas fitting, call-bells, locks, hotel and house annunciators, telephones, fire alarms, etc. The electrical department will be under the management and personal supervision of Mr. C. Barnard Arsino, who is well-known among the leading electrical houses of New England.

ACCIDENT TO ELIHU THOMSON.—An unfortunate accident happened to Prof Elihu Thomson, of Lynn, on Monday, resulting in fracturing the bone of one of his legs, just above the ankle Although not necessarily serious, it will delay the professor's work considerably. He has been an enthusiastic investigator of the Röntgen discovery, and after the fracture was set had a Röntgen ray picture taken of it. The result was very satisfactory, showing the surgical adjustment of the bone to be most perfect and only a fine line showing the break. Another picture will be taken with an improved Boston tube immediately, and even clearer results are expected. He is at present at his residence at Swamscott, Mass.

WASHINGTON NOTES.

WASHINGTON, D. C., May 7, 1896.

THE ELECTRICAL WORKERS will move into their new quarters, 508 Eleventh Street, Northwest, about the last of this month. They will have a library, lecture and smoking rooms, and a telephone service.

THE POTOMAC ELECTRIC POWER COMPANY has filed articles of incorporation. The object is to manufacture, buy, sell, and distribute electricity and electric appliances. The amount of capital stock is $500,000 divided into 5000 shares at $100 each. The principal works of the company are to be located at the corner of Thirty-third and K Streets.

EXTENSIONS.—The Senate has passed the bill to extend the Eckington & Soldiers' Home and the Belt Company street railway lines. The bill provides that within three months the companies shall make a trial of the compressed air motors. If the motors are, upon three months trial, approved by the Commissioners as a speedy and convenient power for the street cars, permits are to be issued for the full equipment of the two lines.

LANDING OF CABLES.—Representative George L. Wellington, of Maryland, has introduced a bill in Congress providing that the shore end of any marine telegraph cable line or system that shall be hereafter established and protected in any foreign country by exclusive landing rights, or by any other special privileges, shall not be permitted to be landed or operated in the United States territory until Congressional consent is given.

ELECTRIC LIGHT.—In the bill before Congress making appropriations for sundry civil expenses of the Government, an amendment is proposed by Representative J. F. Aldrich, of Illinois, for the extension of the electric light plants in the Capitol and the grounds about the Capitol. Forty-five thousand dollars is asked to be appropriated for an additional engine and generator, the running of conduits, wiring, lamps and fixtures, steam pipe and fitting, cables for feeder system, and for the pay of electricians, wiremen and laborers, the work to be done by the architect of the Capitol, under the direction of the Senate Committee on Rules.

ADVERSE REPORT.—The House bill authorizing the Falls Church & Potomac Electric Road to enter the city by ferry has been reported adversely to Congress by the Commissioners. They object to the ferry feature as they have always done. "Experience," they say, "has shown in the case of the Mount Vernon and Capital roads, that these ferries are never built, but the road at once seeks a bridge at public expense. There is not a street road in existence where the cars are ferried across the river. Such a method is considered unadvisable, especially where there are strong currents, freshets and ice." The Commissioners suggest that any road seeking an entrance into the city near the Aqueduct Bridge be required to construct a bridge of its own across the river.

THE PACIFIC CABLE.—The House Committee on Commerce has again discussed the Pacific cable project. It was decided that if Congress grants a subsidy for a cable it should not be greater than $100,000 a year for 20 years. A substitute bill has been offered by Representative John B. Corliss, of Michigan, to authorize the Postmaster-General to advertise for bids from cable companies for doing the cable business of the United States between the coast and the Hawaiian Islands and Japan for a term of 20 years, under conditions which Congress would prescribe in the bill. The Postmaster-General would report the result of the bidding to Congress at the beginning of the next session, and the offer of the lowest responsible bidder would be accepted. A special meeting will be held next week to again discuss the cable question.

THE CAPITAL RAILWAY COMPANY.—The House Committee on the District of Columbia has reported favorably on the Senate bill amending the charter of the Capital Railway Company so as to allow it to raise the tracks of the Anacostia Railway over the Navy Bridge. This will enable the Capital Railway Company to enter the city by connecting with the Capital Traction Company at the Navy Yard. The bill has already passed the Senate, and will come up for action in the House this week. Should it pass which seems probable, rapid transit will be assured for Congress Heights, Anacostia and Overlook Inn, and an end put to the long fight made for rapid transit by the residents of those suburbs. The report of the House Company amends the Senate bill by authorizing the Capital Railway Committee to connect with the Metropolitan elevated road at Lincoln Park, in addition to the provision for raising the tracks of the Anacostia Railway.

GOVERNMENT TELEGRAPH.—The House Committee on Postoffices and Post Roads heard the representatives of the International Typographical Union this week on the question of governmental ownership and control of the telegraph. Chairman Loud, of the House Committee, stated that it was so late in the present session he felt as though the committees would not be justified to ensure a report to the House Chairman Bromwell, of the sub-committee, was present and manifested much interest in the matter, but informed the representatives of the printers' union frankly that he realized that the question was one of too much importance to even anticipate the hope that the report could be formulated to present to the full committee at this session. He suggested that the matter be pushed as far as possible now, and when the short session of Congress convenes an early start be made, and then greater progress could be attained. Mr. A. L. Randall, chairman of the union's committee, was the first speaker, and he briefly outlined the objects of the advocates of governmental control of the telegraph. Mr. S. H. Bell, also a member of Columbia Typographical Union, followed Mr. Randall and spoke upon the merits of the McGuire bill, now in the House. Another hearing will be given to the representatives of the union next week, and arrangements are nearly completed for hearings before the Senate Committee.

SUBWAY HEARING.—The new municipal subway bill has been discredited before the House District Committee by representatives of existing corporations that would be called upon to use the subway. President Bryan, of the Chesapeake & Potomac Telephone Company, found fault with it from beginning to end. He stated that every section of it showed evidences of ill-advised preparation. Mr. Bryan was doubtful whether a municipal subway system was feasible at all. St Louis, after years of investigation along that line, had recently abandoned all ideas of a municipal subway. Such a system in Washington would only be practicable after consultation with experts and between different companies that would use the ducts. Superintendent Marean, of the Western Union Telegraph Company, speaking unofficially as an electrician and not as a representative of the company, suggested that the subway bill, if enacted, might come into conflict with the National Telegraph Act, under which the telegraph companies are doing business here. He concurred in many things Mr. Bryan had said about the practical features of the subway system, and stated that it would require a great deal of attention, and the technical ability to shape a bill that would satisfy the conflicting interests. Mr. Marean said that there were from 1000 to 1500 miles of overhead telegraph wires in the District of Columbia. Mr. John J. Hemphill, in behalf of the Home Telegraph Company, asked if the bill be passed it be amended so as to authorize his company to lay wires in portions of the city where the municipal subway would not exist.

THE TELEGRAPH CORPS.—Representative J. A. T. Hull, of Iowa, from the Committee on Military Affairs, to whom was referred the bill for the relief of telegraph operators who served in the War of the Rebellion, has reported it favorably, with the recommendation that it pass. The subject matter of this bill has been before Congress for several years. It has been the avowed policy of the Government not to recognize as a part of the Army those persons who filled civilian positions. In places of that character no stipulated term of service was agreed upon, and at any time it was optional with the persons interested whether they should continue to serve the Government or not. They were not subjected to military discipline, and ordinarily they were not put in places of danger to life and limb. But the case of the telegraph operators is somewhat different. Their services were important and valuable. Wherever headquarters were established the telegraph operators were always stationed. The construction of the telegraph lines often involved danger, and the Committee on Military Affairs is of the opinion that a slight departure from the policy of the Government in not recognizing civilian employees of the army is justified in this case. The committee recommends the passage of the bill with the following amendment: "That the Secretary of War is hereby authorized and directed to prepare a roll of all persons who served in the operation of military telegraph lines in the late civil war, and to issue to each, upon application, unless it appears that his service was not creditably performed, or to the representatives of those who are dead, suitable certificates of honorable service in the military telegraph corps of the Army of the United States, stating the service rendered, the length of such service, and the dates as near as may be, between which such service was performed, provided that this law shall not be construed to entitle the persons herein mentioned to any pay or rights not especially provided for." The bill in its amended form meets the approval of the commanding general of the army.

WESTERN NOTES.

Branch Office of THE ELECTRICAL WORLD,
936 Monadnock Building,
CHICAGO, Ill., May 9, 1896.

THE LAKON COMPANY, manufacturer of the Lakon transformer, has removed its Chicago office, which is in charge of F. S. Terry, to suite 1509-10-11 Monadnock Block.

THE SUNBEAM INCANDESCENT LAMP COMPANY, Chicago, has removed its offices from the Title and Trust Building to suite 1509-10-11 Monadnock Block, where it will have much more commodious quarters.

THE CUTTER ELECTRICAL & MANUFACTURING COMPANY, manufacturer of the C. S. flush push switches and the I. T. E. circuit-breakers, has removed its western office to suite 1509-10-11 Monadnock Block, Chicago.

WOOD & SPEED, dealers in electrical supplies, Louisville, Ky., have succeeded to the business of the Electrical Supply & Construction Company, at 235 Fifth Street, that city. The members of the firm are Harry I. Wood and Buckner Speed.

THE LAKON COMPANY will shortly issue from their Chicago office, in the Monadnock Block, a new catalogue of Lakon transformers. This catalogue will contain information of general interest and value to users of transformers and when published will be sent to any one making application for it.

MR. E. P. ROBERTS, consulting engineer, and president of the Correspondence School of Technology, Cleveland, O., has been appointed consulting engineer for the Port Clinton (O.) Electric Light & Power Company. Mr. Roberts is also consulting engineer for the Columbus State Hospital. These are new plants and bids for the same will be called within the next 30 days.

THE ELECTRIC APPLIANCE COMPANY, Chicago, is carrying a large and well assorted stock of the celebrated "Electra" imported carbons, which are recognized as a very high grade article. They have an exceptionally long life, owing to the fact that almost the entire carbon is consumed, the amount of dust being reduced to a minimum. Prompt shipments are made from Chicago stock.

THE CUTLER & HAMMER MANUFACTURING COMPANY, Chicago, has purchased the plant of J. Holt Gates, and moved in very much larger quarters at 70-82 Jackson Street. The Cutler Company will add its own machinery to its new acquisition, and when everything is settled down to a working basis, will employ 50 men regularly. The company is now in a position to handle its growing business with greater facility.

THE ARNOLD ELECTRIC POWER STATION of Chicago, which was recently organized to build electric power plants under the patents issued to Mr. B. J. Arnold, is busy erecting the following plants: The Chicago Board of Trade, 300 horse-power, using Ames engines and Westinghouse generators, 275 revolutions per minute; the Englewood & Chicago Electric Railway, 100 horse-power, using Willans engines and Walker generators, 380 revolutions per minute; the Suburban Railway, 1000 horse-power, using Providence Green engines and Siemens-Halske generators, 1000 revolutions per minute. The company has only been in business a short time, but its system has been favorably received wherever presented The first plant installed under this system was put in operation at Fort Dodge, Ia., July 1, 1895, and has been in successful operation since. Mr. G. F. Wheeler, formerly of the Williams Engine Company of Beloit, Wis., and later with the Fort Wayne Electric Corporation, has been engaged as general sales agent. His extensive experience in this class of work makes him a valuable acquisition to the company.

A new telephone lately put on the market is that of the Automatic Long Distance Telephone Company, of Chicago, which that company claims is a radical departure in telephone construction, inasmuch as the long-established vibrating diaphragm system is abandoned and the granulated carbon transmitter is operated by a diaphragm in which the vibrations are suppressed and the agitation of the carbon granules is obtained by means of molecular disturbance of the mass of the diaphragm and the sound waves passing therethrough. The difference is illustrated by a wire laid without dampers on the streets. In one case the multiplication of gradually diminishing vibrations is obtained, which effects a clear timbre of sound, while in the other a clear staccato note is produced. The non-vibrating diaphragm, it is claimed, gives the pure timbre of the natural voice, eliminating other sounds or vibrations of one note mixing with another which follows it. The switching for this telephone is a mercurial one hermetically sealed in a case so as to protect it from the corrosive effects of the atmosphere. Another feature is the automatic means of keeping the space between the ends of the extension pieces and the diaphragm adjusted, irrespective of the atmospheric changes. The transmitter is also made to be automatically revolved, thereby maintaining the granulated carbons in a free and loose condition, an essential feature for proper action in order to make and break the current flowing from one electrode to the other. These features are patented by the above company.

COLORADO NOTES.

DENVER, COL., May 5, 1896.

THE MEETING of the Denver Medical Society on April 28 was devoted to a consideration of the importance of the Röntgen rays from the surgeon's point of view. A large audience was present, as invitations had been extended to many persons interested in the developments in this field. Several photographs taken by Charles F. Lacombe, James Johnston and Frank J. Haffer were shown successfully by means of the stereopticon.

ALL THE ELECTRICAL COMPANIES of Cripple Creek suffered severely in the two conflagrations which practically wiped out the famous mining camp. None of the structures occupied by the companies were touched by the first fire, but the second which swept through the central part of the town destroyed all of these buildings with the exception of the electric light station. This structure is located close to the Portland Hotel, where the last fire originated, but it fortunately was not in the path in which the wind drove the flames. The station which was described in THE ELECTRICAL WORLD of April 11 is a substantial brick structure, and has been one of the most pretentious buildings in the camp. The company's loss is hard to estimate. Practically all its circuits, lamps and poles were destroyed. Before the fire had burned itself out, the company was preparing to furnish lights for outdoor illumination, and not many hours elapsed before arc lamps were burning in some of the more important points of the city wires were attached to portions of old poles and new poles were set as soon as possible. Although the fire started at a point near the telegraph offices, those in charge at once realized that their buildings were doomed, and made immediate preparations to save their plants so far as possible. Both the Western Union and Postal were able to carry away their instruments, and within two or three hours temporary locations were secured, and business was proceeding without interruption. An extraordinary number of messages was received, and it is stated that never in the history of the State has such a volume of business been transacted with a mining camp. Later the Western Union found quarters in the Masonic Temple, almost the only brick building left standing, and the Postal opened an office in a comfortable tent. Both companies sustained losses by the destruction of wires and poles, but these are inconsiderable. The Colorado Telephone Company was doubtless the largest loser among the electrical companies, and its losses will probably aggregate $8000. Its exchange was not touched by the first fire, as has already been stated, but it lost many of its cables and poles. In order to maintain the service a temporary exchange was opened at the east end of the town, where most of the wires and cables enter the camp, and trunk lines were carried to the old office. A construction gang happened to be on the spot engaged in substituting new poles and wires for the original construction, and the work of repairing the damage temporarily was soon accomplished. The routine of business had been well established when the second fire broke out. The exchange lay directly in the path of the conflagration, and the manager at once went to work to save the switchboard. This was finally removed and carried to a safe place, somewhat damaged, but still in a serviceable condition. The operators then scattered to save their personal effects. Almost without exception the homes where they had boarded were burned, but not before their trunks had been carried to places of safety. The families of some of the young women lost all their earthly possessions with the exception of a few personal effects. The business was conducted for a day at the temporary exchange opened up at the eastern end of the camp. It was located on a platform built on the outside of a warehouse, and shelter was provided by a few rough boards. Four wall sets were attached to the sides of the rough enclosure and those who used the instrument were obliged to converse in the hearing of an impatient throng waiting for their turn. A temporary office was secured in the Masonic Temple, and the exchange was connected to it by means of trunk lines. The repair work was rapidly done by the construction gang; temporary poles were set where necessary, old, broken, and partially burned poles were used whenever practicable, and in many instances poles were lashed to the charred butts of the old poles. The head quarters of the construction gang in Poverty Gulch were not visited by the flames, and as sufficient provisions were on hand the employees did not suffer. The company opened a temporary boarding house for its employees, and all were well cared for. Long before the ground had cooled Superintendent Burgess, of the Colorado Telephone Company, purchased a lot on Third Street as a site for a telephone building. Plans have already been prepared for erecting a practically fire-proof building. He determined to build at once on the lot a wooden shack as a temporary home for the exchange. The utmost expedition was necessary in the construction, as the time during which the building of such structures was permitted has been limited by the City Council. Work was commenced at 2 o'clock on one afternoon, and by 5, the end of the time allowed by the aldermen, the shack was built and roofed over. Arrangements were at once made to transfer the plant to the new quarters. The new building will be erected over the shed, and the latter will not be torn down until a room is ready for occupancy on the second story.

ENGLISH NOTES.

(From Our Own Correspondent.)

LONDON, April 20, 1896.

EXPERT EVIDENCE.—A good many hard things have been said against expert witnesses, and it was reserved for Mr. Justice Wills in a recent action which resulted in a partial victory for the Welsbach patent to rehabilitate this species. After paying a series of compliments to various expert witnesses employed on either side, Mr. Justice Wills referred to Mr. James Swinburne, the well-known electrical engineer upon whom the brunt of the battle of defending the Welsbach patent fell. The judge remarked that Mr. Swinburne gave his evidence "with a perfect frankness, truth and indifference to consequences, which made him the ideal of what a scientific witness should be."

THE ALTERNATE-CURRENT ARC.—The latest development in the theory of the alternate-current arc has been published in the paper read before the Physical Society last Friday by Mr. J Frith. In this paper it was shown that when an arc is connected to an alternator in such a way that practically the whole of the load is contained in the arc, that is to say, that there is no resistance or reactance in circuit with the arc, whatever the natural wave form of the alternator, the arc seems to have the power of distorting that wave form into a flat-topped wave, which, curiously enough, is the most efficient wave for arc lighting. On the other hand, if the arc represents only a small proportion of the whole load on the alternator, there is practically no distortion of the wave form. The alternator with which Mr. Frith experimented had an iron-cored armature, and it was suggested by Dr. S. P. Thompson that possibly the explanation of the curious phenomenon is to be found in the presence of this iron. It remains to be seen whether with a non-iron cored armature any such distortion of the wave form by an alternate arc would take place.

ACCIDENTS DUE TO HIGH-PRESSURE CURRENTS.—I have for some little time been waiting for some one to make trade capital out of the many regrettable accidents which have occurred to workmen in connection with high-pressure plants. The "honor" of being first in this race has fallen to Mr. A. L. Fife, who recently wrote to the Board of Trade to inquire how many accidents had occurred in connection with high-pressure alternate currents, and he was informed that nine cases of fatal accidents had occurred to employees at generating or transforming stations where high-pressure alternate currents were used, while no instances had been reported to the Board of Trade of similar accidents in connection with low-pressure continuous currents. This result has been blazoned forth by Mr. Fife in a letter which has been sent to all the daily and weekly, provincial and metropolitan papers. The object of distributing this information broadcast is, no doubt, to inspire a feeling of danger in the minds of householders whose houses are connected with alternate-current systems. It is difficult to stigmatize this method of warfare with sufficient warmth without transgressing the limits of parliamentary language.

ELECTRIC LIGHTING OF THE SIDE STREETS OF LONDON.—Some interesting and much needed experiments are about to be carried on in connec-

tion with the electric lighting of the side streets of the City of London. As your readers are no doubt aware, all the main streets of the city have for some few years past been lighted entirely by arc lights. There is, however, a clause in the contract between the city authorities and the City of London Electric Lighting Company, which binds the former to have every side street and alley also electrically lighted. Owing possibly to the difficulties which the company has had with its machinery, it has not pressed for the fulfilment of this contract. Now, however, that these difficulties are becoming a thing of the past, it has begun to inquire when this clause is going to be carried out. But the city authorities were somewhat shy of committing themselves to the lighting of the innumerable alleys to be found in the City of London by such an expensive illuminant as electricity. Indeed, one member of the lighting authority went so so far as to say that in his opinion, the lighting of the side streets of the city by means of glow-lamps would prove as expensive a luxury as watering them with rose water Down at Brighton, it is true, Mr. Arthur Wright is able to supply current for street lighting purposes at 2d. per kw-hour, and is thus able to light the side streets of Brighton by means of glow-lamps fixed in the old gas-fittings, at 10 shillings per lamp per annum less than the contract price for gas, and obtain, withal, a decidedly greater and better distributed illumination. The City of London Electric Lighting Company, however, having a monopoly and a comparatively short tenure in which to recoup itself for their immense capital outlay, are not likely to supply current for street lighting purposes at anything like 2d. per unit, hence the lighting authority is quite right in taking every precaution before committing itself into the company's hands. The upshot is that exhaustive experiments with a few 7-ampere arc lamps and 200-watt glow-lamps are about to be carried out in the city. Different types of shades, projected globes and brackets are to be used for the glow-lamps, and for the arc lights carbons of different diameters and quality and globes of different shapes and degrees of obscurity. Accurate photometric measurements will be taken, and finally the alternate-current arcs will be supplied with continuous current. It is to be hoped that the outcome of these experiments will be some real and commendable street lighting with small current arc lamps and street glow-lamps.

General News.

New Incorporations.

THE PRINCETON TELEPHONE COMPANY, Princeton, Mo., has been incorporated with a capital stock of $1000 by Ira B. Hyde, H. G. Orton and H. C. Miller.

THE PLEASANTON TELEPHONE COMPANY has been organized at Pleasanton, Ia., by John Painter, Erastus Graham, Joseph Leeper, A. Cozad, C. Spargur and James Estis.

THE FAIRBANKS ELECTRIC BELL BUOY COMPANY has been incorporated at Portland, Me., with a capital stock of $200,000. The promoters are C. E. Littlefield and Charles S. Dennis.

THE WAUKON ELECTRIC LIGHT COMPANY has been organized at Waukon, Ia., by Clark W. and H. W. Thompson, of La Crosse, Wis, and C. F. Speed, of McGregor. The capital stock is $12,000.

THE OSKALOOSA ELECTRIC LIGHT, POWER & HEATING COMPANY has been incorporated at Oskaloosa, Kan, with a capital stock of $5000, by W. A. Coy, W. L. Van Cleave, C E. Chase and W. L. Critchfield.

THE MECHANICAL & ELECTRICAL MANUFACTURING COMPANY, Jersey City, N. J, has been organized with a capital stock of $50,000, by Edward Denning, William C. Dillman, Cornelius Olsen and William C. Lord, Brooklyn, N. Y.

THE LEFFLER ELECTRIC CONTRACT COMPANY, New York, N. Y., has been incorporated in West Virginia by William A. Vincent, Adams A. Goodrich and Frederick J. Patterson, Chicago, Ill. Capital stock, minimum, $1,000; maximum, $5,000,000.

THE WESTON ELECTRIC LIGHT COMPANY, Weston, Mass., has been incorporated by Albert H. Hews, Horace S. Sears, George S. Perry, Robert Winsor, and Fred W. Jackson, for the purpose of generating electricity for light, heat and power. Capital stock, $7000.

THE MACAN COMPANY has been incorporated at Philadelphia, Pa., with a capital stock of $50,000 for the purpose of manufacturing insulating material. The incorporators are William A. Macan, Ridley Park, Pa.; R. Willis Lysle, Philadelphia, Pa, and Evan Rice, Ridley Park, Pa.

THE WARD LEONARD ELECTRIC COMPANY, Hoboken, N. J., has been formed by H. Ward Leonard, East Orange, N. J.; William Pelzer and Daniel H. Driscoll, New York City, for the purpose of manufacturing and installing electrical apparatus of all kinds. Capital stock, $100,000.

THE DUNKIRK ELECTRIC LIGHT & POWER COMPANY, Dunkirk, Ind., has been incorporated by Edward Gormley, Joseph C. Cockburn, Clarkson W. Macy and William J. Fraser, for the purpose of operating an electric plant, to furnish light, heat and power. Capital stock, $20.000.

THE NON-POLARIZING DRY BATTERY COMPANY, New York, N. Y., has been organized for the purpose of manufacturing and selling electric dry batteries and general electric supplies. The incorporators are J. C. Kaempfer, Jacob Liebes and Adolph Liebes, New York City. Capital stock, $100,000.

THE SILICA-HYDRO CARBON COMPANY has been organized in New York City, N. Y., for the purpose of manufacturing material, etc., used for electrical conduits, The incorporators are William A. Cashen, Isidore J. Pocher and William M. Graves, of New York City. Capital stock, $100,000.

THE INSULATOR COMPANY has been organized in New York City for the purpose of manufacturing insulators for electric railway, light, telephone and telegraph. The capital stock is $25,000, and the incorporators are H. S. Newton and W. B. Smith, of Syracuse, and Albert Vickers, of New York City.

THE NATIONAL UNDERGROUND CABLE COMPANY, Hastings, N. Y. has been incorporated by J. P. McQuaide, Nyack; Cornelius Gallagher, New York, and C. J. Jackson, Brooklyn, for the purpose of manufacturing and selling wires, cables and electrical conductors and all kinds of railway equipment. Capital stock, $200,000.

Telegraph and Telephone.

DELHI, N. Y.—This place is to have a telephone exchange.

TRENTON, MO.—Trenton and Spickards are being connected by telephone.

SHELOCTA, PA.—Residents of Shelocta are agitating the question of a telephone line.

BARDWELL, KY.—This place now has telephone connection with Milburn and Arlington.

ANITA, IA.—The construction of a telephone line from Anita to Massena and Cumberland is contemplated.

EVANSVILLE, IND.—The Dane County Telephone Company is at work on a line between here and Stoughton.

DETROIT, MICH.—The Detroit Telephone Construction Company will soon begin the work of putting down conduits.

HAVANA, ILL.—A franchise has been granted to W. A. Richert to establish and operate a telephone exchange at Havana.

PORTAGE, WIS.—A new telephone exchange here will be put into operation about June 1. There will be 80 subscribers to begin business with.

ELKINS, WEST VA.—The railway company is about to erect a telephone line from here to Thomas, West Va. Work is soon to be commenced.

MT. CARROLL, ILL.—A telephone line is talked of between Mt. Carroll and Stockton, also between Stockton and Elizabeth, then connecting with Galena.

MARINETTE, WIS.—The long-distance telephone line which now ends at Menominee is to be extended to Escanaba, Marquette and other cities in this section.

LA GRANGE, ILL.—The La Grange Automatic Telephone Company, after an existence of nearly two years, has been wound up and the property disposed of.

KNOXVILLE, TENN.—The Nolachucky Telephone Company is extending its line from Jonesboro to Greenville and will soon connect with Knoxville and Chattanooga.

DENISON, TEX.—The Southwestern Telegraph & Telephone Company are building a metallic circuit line from Dallas to Denison. The work will be completed about June 1.

PRESTON, MINN.—A telephone line is to be constructed from Preston to Cresco by way of several places. Arrangements have also been made to extend the line to Lime Springs *via* York.

STROUDSBURG, PA.—The telephone line now in operation between Stroudsburg and Bushkill will be extended to connect with the line between Dingman's Ferry and Port Jervis.

Electric Light and Power.

RARITAN, N. J.—Raritan possesses new electric lights.

ROSSVILLE, ILL.—Rossville has voted for electric lights.

SUPERIOR, WIS.—An electric light plant will be built on the ore dock.

KENNETT, PA.—This town is to be lighted with incandescent electric lights.

WESTON, O.—An electric lighting plant is soon to be installed in this place.

WEST UNION, IA.—An electric light plant has been contracted for in this city.

DES MOINES, IA.—The electric light company will be required to put its wires underground.

MIDDLEPORT, N. Y.—The Middleport *Herald* is agitating the question of electric lights for that village.

MILLVILLE, N. J.—Millville City Council will consider the question of erecting an electric light plant.

BRIDGETON, N. J.—An electric light plant is to be erected in this city which will undertake commercial service

ST. LOUIS, MO.—The International Electric Company filed articles increasing its capital stock from $15,000 to $20,000.

VICKSBURG, MISS.—At a recent election the proposal for the erection of a municipal electric light plant was defeated.

HAZLEHURST, MISS.—An election will be called at once to vote on a municipal water works and electric light plant.

DUNKIRK, N. Y.—The Board of Water Commissioners voted unanimously to provide for an incandescent electric light plant

JACKSONVILLE, FLA.—The contract for lighting the public buildings has been given to the municipal electric light company.

CAMBRIDGE, MASS.—The project that the city establish and maintain an electric light plant was defeated at a special election.

BERKELEY, CAL.—The stockholders of the Berkeley Electric Light Company have decided to create a bonded indebtedness of $30,000.

CHESTER, PA.—The Beacon Electric Light Company has signed a contract for lighting the city for the next five years, and will build a plant.

DAYTON, TENN.—John Crawford, Thos. Webb and S. Nelson have purchased the electric light plant at this point, and will put it in operation.

MT. PLEASANT, IOWA.—The citizens of this place voted that the city should put in and operate its own electric light plant at a cost not to exceed $13,500.

BELLEVUE, IA.—A committee of three has been appointed to obtain plans and specifications and advertise for bids for an electric light plant. W. F. Schermer, Recorder.

SENECA, KAN.—One of the finest electric light systems in this part of the State has been installed at this place. The latest design of machinery and apparatus has been used.

GAYLORD, MICH.—Gaylord is to have electric lights. If the vote for village ownership fails to carry the Council has provided for a franchise to be granted to a private company.

SAN FRANCISCO, CAL.—The Edison Light & Power Company, in a recent bid for lighting the streets of this city, offered to furnish electric lights at 11 cents per thousand watt hours

HARRISBURG, PA.—The new building now being erected by the Cumberland Valley Railway Company, at the corner of Fourth and Chestnut Streets, is to be wired for electric lighting.

ATLANTIC HIGHLANDS, N. J.—At the last Council meeting George H. Stout, Jr., offered to take the whole $15,000 bond issue of the borough for an electric plant at 5 per cent. interest.

ARDSLEY, N. Y.—A. E. Barnett will erect a model office building on the site of the old shoeshop, which is occupied by the Ardsley Club. The building will be illuminated with electricity.

DAVENPORT, IA.—The Davenport Gas, Electric Light & Steam Heating Company last week began setting poles and making ready to put up its new wires for the electric lighting of the city.

NORWALK, CONN.—The bondholders of the Norwalk & South Norwalk Electric Light Company have made application for an order of sale, and it is probable that their request will be granted.

ORANGE, N. J.—The People's Electric Light & Power Company is increasing its power capacity for the purpose of furnishing current for the operation of electric fans and other light power plants.

MEDINA, N. Y.—It is probable that Medina will build an electric light plant of her own, owing to a raise in rate from $60 to $75 per light by the company which has heretofore been supplying the town.

DOVER, N. J.—A special meeting of the directors and stockholders of the Electric Light Company was held, and it was decided to build. The new plant which will be built of brick and iron, will cost about $30,000.

CANNON FALLS, MINN.—The Cannon Falls Electric Company has secured a five-year franchise and contract for the lighting of this town. They have commenced installing a 600-light plant, and expect soon to have it in operation.

HORSELESS CARRIAGES.—A speed contest and exhibition of horseless carriages will be held at the Rhode Island State Fair, in Providence, Sept. 7–11 next. Prizes to the amount of $5000 will be awarded to successful competitors.

SCRANTON, PA.—P. J. Horan, of Dunmore, and Charles H. Schedt, of Scranton, are now adding improvements to the Hotel Pines and the Lake House. An electric light plant is to be put in for the use of the hotels, cottages and dwellings.

ORANGE, N. J.—A movement is on foot in East Orange to have that township lighted by electricity instead of gas. Some time ago the East Orange Improvement Society appointed a committee of five to look into the cost of electric lighting.

CRYSTAL SPRINGS, MISS.—J. G. Siebe & Son are preparing to install an isolated electric light plant in their drug store. It will have a capacity of 50 lights and several electric ceiling fans. They will use a gasolene engine and direct 110-volt dynamo.

PORTLAND, ME.—The Committee on Street Lights is considering the advisability of appointing an inspector of lights to see that the city is getting all the illumination it pays for. If the Council appoints the inspector, it is thought he will be a very busy man.

SALT LAKE CITY, UTAH.—The franchise of the Ogden Gas & Electric Light Company has been revoked by the Council, owing to alleged violations of the terms of the charter. The council did not state in what way the company had violated these terms.

LUVERNE, MINN.—In 1892, the village of Luverne erected an electric light plant at a cost of $8,000, and have since added improvements to the amount of $13,000. By careful economy on the part of village officials the entire cost has been paid, and the plant is out of debt.

NEWARK, N. J.—The Mayor has vetoed the bill to establish an electric lighting plant in Centre Market, this city, and the Common Council has sustained the veto. The effect of the agitation, however, resulted in a reduction of rates by the existing company which is serving the light.

THE ELECTRIC ARC LIGHT COMPANY.—The Pioneer lamp has won the confidence of several parties having a capital of over $2,000,000, who are now backing up the Electric Arc Light Company in the fullest manner. A firm and aggressive policy has been adopted by the company, manufacturing on a large scale, advertising freely, and establishing agencies throughout the country. Elegant offices have been fitted up at 687 and 689 Broadway, and a fine laboratory at 250 and 252 Mercer Street, New York City. The rights of the Pioneer lamp, the company states, will be strongly protected, and all infringements on its patents will be punished to the fullest extent of the law.

PHILADELPHIA, PA.—It looks as if the deal by which all the principal electric light companies in the city will be brought under one management will be consummated. Negotiations are already under way for the absorption of the electric trust which controls the Brush, United States, Philadelphia and Northern Electric Light Companies, by the Pennsylvania Heat, Light & Power Company, which recently acquired through ownership of a majority of its capital stock, control of the Edison Company. The capital stock of the trust is $3,644,000, of which $3,144,000 is common stock and $500,000 preferred. If the proposed negotiations are successfully carried out, the Pennsylvania Company will control the electric light business in practically all of the business centres and most thickly populated parts of the city.

NEW HAVEN, CONN.—By the new contract with the New Haven Electric Light Company, the city will save on 404 lights for three years the sum of $13,271.50. An important provision is made in this proposed contract which has never been made in contracts heretofore made. It is that the lamp inspector or any agent of the city shall have access to the electric light company's plant at any time, for the purpose of making tests to ascertain the power of the current used, and to see if it is up to the required standard. The city agrees to continue at least 373 electric lights during the next three years. If on a test the city's representative finds that the current is not up to the required standard, nothing shall be paid by the city for the light furnished until the trouble is rectified. It is also provided that where lights are out during the night, that proportionate deductions shall be made in the amount the company shall receive.

THE ELECTRIC RAILWAY.

KINGSTON, N. Y.—A franchise has been granted to the Kingston & Lake Katrine Railway Company

THOMASTON, ME.—Work will be commenced at once on the construction of the electric railway at Thomaston.

ALBANY, N. Y.—The preliminary work on the proposed Albany & Schoharie Electric Railway is progressing rapidly.

WARREN, O.—The contemplated electric railway from Warren to the Lake is favorably considered here and at Ashtabula.

WAUKESHA, WIS.—A new electric railway is to be built in this place, which will touch every hotel and important spring in the village.

HARRISBURG, PA.—Ten handsome new summer cars have been received from the J. G. Brill Company, of Philadelphia, by the Harrisburg Traction Company.

WATERTOWN, N. Y.—It is said that the Rome, Watertown & Ogdenburg Railway Company contemplates building a road to Cook's Clearing at the foot of Cranberry Lake.

STEWARTSTOWN, PA.—The interest in the electric road from Stewartstown to Fawn is being kept up, and it looks as though that section of the road would be built before long.

READING, PA.—The Neversink Mountain Electric Railway Company has just decided to build a branch line a mile in length, extending through Park Glen, from Klapperthal Park.

BROOKLYN, N. Y.—It is understood that the Kings County Elevated Railway Company is considering the advisability of adopting the Reno inclined elevator at the principal stations on its line.

PORTLAND, ME.—The Cape road is circulating petitions at Bradley's Corner and Town House Corner, asking that it may extend its tracks from Bradley's Corner to Town House Corner.

OSWEGO FALLS, N. Y.—The Board of Trustees has granted the Fulton & Oswego Falls Street Railway Company the right to lay tracks in Oswego Falls. It is expected that work will soon be commenced.

ATLANTA, GA.—The Collins Park & Belt Electric Railway Company has completed arrangements for the extension of its line from its present terminus at the Chattahoochee River to Iceville, a distance of half a mile.

HARTFORD, CONN.—Work on the extension of the tracks of the Central Railway & Electric Company of New Britain, from New Britain to Hartford, has been temporarily suspended in consequence of an injunction.

OSWEGO, N. Y.—The plans for the new barn for the electric railway have been completed, and the contract is about to be let to the lowest bidder. The building will be 26 by 150 feet, with double tracks large enough to hold 10 cars.

WOONSOCKET, R. I.—One of the walls of the tail-race of one of the Woonsocket Electric Company's mills was recently undermined by a muskrat, the damage necessitating the shutting down of the mill one day for repairs.

ALLEGHENY, PA.—The Allegheny Committee on Public Safety, at a meeting to be held soon, will take action on the best and most practical way of regulating the speed of street cars, which by many is thought to be excessive at present, especially at the crowded points.

BENNINGTON, VT.—At a meeting of the stockholders of the Bennington Electric Railway the director were instructed to at once make preliminary arrangements for the construction of the road to the State line, *via* North Bennington. Work will be begun as soon as possible.

MERRILL, WIS.—The Merrill Railway & Lighting Company have added a 150-hp engine to their power equipment. The engine will assist the water wheels in furnishing power for electric lighting, and govern the speed of the dynamo shafts so that the lights will be uniform.

UHRICHSVILLE, O.—The Uhrichsville & New Philadelphia electric road will be built in the next 90 days. It is capitalized at $150,000 and the stockholders live in Akron, Cleveland and Pittsburg. The Cleveland Construction Company has secured the contract to build the line.

PORT RICHMOND, S. I., N. Y.—After months of delay the Staten Island Electric Railway Company started to run cars across the tracks of the Staten Island Rapid Transit Railway at Clifton, last week. This makes the road continuous from Port Richmond almost to South Beach.

LONG BRANCH, N. J.—The question of how the Atlantic Coast Electric Railway Company shall cross the New Jersey Southern Tracks in Second Avenue will be decided before Chancellor McGill, in Jersey City. The railway people want the trolley company to build a trestle 500 feet long.

NEW HAVEN, CONN.—The Manufacturers' Street Railway Company has secured the right of way for an electric road for freight purposes, to run from a freight depot to a manufacturing section, part of the way on private land and part on the streets. It is expected to have the road in operation by Oct. 1.

BROOKLYN, N. Y.—The negotiations between the Brooklyn Heights Railway Company and the Brooklyn & Rockaway Beach Railway Company, which have for their purpose the buying or leasing of the Canarsie road and its conversion into a trolley line, promise a successful termination.

NIAGARA FALLS, N. Y.—The Buffalo & Niagara Falls Electric Railway Company is preparing its poles for another feed wire from the power house in this city. It is understood that it is to run the cars from Tonawanda, the

present power from here only going to Gratwick, where the steam plant of the company is used to the Buffalo city line.

PEORIA, ILL.—Peoria is to have a new railway line. When completed it will probably be known as the Peoria & Glen Oak Railway. It will be an electric railway, and is destined to connect the Union Depot and Prospect Heights. Those interested are Moses Seiberling, president of the Seiberling Rubber & Bicycle Company, and W. E. Avery, of Detroit.

BROOKLYN, N. Y.—Police Commissioner Welles instructed all the captains and commanding sergeants to order the men of their respective commands to keep watch on the trolley cars and report any violations of the speed ordinance. The trolley cars, it is said, are operated at a speed exceeding the legal limit, and many complaints have been made recently.

CORINTH, N. Y.—A scheme is on foot to build an electric railway between Corinth, Saratoga County, and the Champlain Canal. The enterprise is undertaken principally by the gentlemen interested in the Hudson River Pulp & Paper Company, at Palmer's Falls, near Corinth. The power to generate the electricity will be furnished by the falls of the Hudson at Palmer's.

ASHLAND, O.—The County Commissioners have granted the Mansfield & Wellington Electric Railway a franchise throughout the northwestern part of the county. It is expected to be in operation as soon as it can be built and extended through to Cleveland. The line will be extended to Elyria by way of La Grange and Oberlin, to connect with the Cleveland and Elyria electric line.

BROOKLYN, N. Y.—The suit against the Nassau Electric Railway Company, of Brooklyn, N. Y., for an annulment of the franchise on the ground of fraud and irregularity has been discontinued. The company now offers to reimburse the city for the expense involved in the litigation and pay 3 per cent. of its gross receipts to the city from the time the road commenced its operations.

BROOKLYN, N. Y.—The presidents of the various surface railway companies in this city called upon the Mayor on Thursday last and requested him to do something in the way of having the present speed ordinance changed, so that the cars may be allowed to run at a faster rate in certain parts of Brooklyn. The Mayor requested the gentlemen to communicate their desires in writing and then he would consider the matter.

JAMAICA, L. I., N. Y.—Application was made to the Board of Supervisors at their session for a franchise to build a trolley line from Jamaca to Hempstead along what was formerly the Plank Road. The application was made in behalf of the Long Island Electric Railway Company, of which A. B. Hart is president. The company's representative, who appeared before the Board, stated that the company was willing to begin work as soon as the macadamizing of the road commenced.

Personal Notes.

MR. FRANK C. COSBY, formerly on the engineering staff of the Westinghouse Manufacturing Company, is now superintendent of construction in the Chicago office of the Standard Underground Cable Company.

MR J. B. CROUSE, president of the Crouse-Tremaine Carbon Company, Fostoria, O., was born in Hartland, Mich , in 1843, and educated at Ann Arbor, Mich., while Mr. H. A. Tremaine, secretary, treasurer and superintendent,

Mr. J. B. Crouse.

Mr. H. A. Tremaine.

H. Stillson Hart.

was born in Watertown, N. Y., in 1852, and is a graduate of the University of Michigan, Ann Arbor. In 1884 Mr. Crouse and Mr. Tremaine (who since 1880 had been partners in another business) began the manufacture of carbons in Cleveland, O., organizing a company known as the Cleveland Carbon Company. In 1889 this company consolidated with the Bolton Crystal Carbon Company, forming the Standard Carbon Company, of which Mr. Crouse was elected vice-president and manager of the sales department and Mr. Tremaine, secretary. In 1893 they both disposed of their interest in the Standard Company to the National Carbon Company, and immediately afterward established the Crouse-Tremaine Carbon Company, the output of which is of so uniformly excellent a quality that the facilities of the factory are taxed much of the time to keep up with the orders. H. Stillson Hart, recently appointed eastern representative of the Crouse-Tremaine Carbon Company, with headquarters in New York, was born in Clinton, Ia., in 1870 and is a graduate of the Rose Polytechnic Institute (Electrical Engineering Course, Class 1893.) For some time he was employed in the installing department of the Siemens-Halske Electric Company, Chicago. In 1894 he accepted the position of western sales agent for the Crouse-Tremaine Carbon Company, with headquarters in Chicago, which position he successfully filled until his recent promotion.

Trade and Industrial Notes.

THE DAVIS & EGAN MACHINE TOOL COMPANY, Cincinnati, O., is mailing to the trade a beautiful hanger. It is finished in twelve colors and is a rare piece of lithography.

PASS & SEYMOUR, Syracuse, N. Y., have introduced a new socket which they call the "Syracuse China" drop socket. They are made to suit all bases and are both key and keyless.

MESSRS. CLARKSON & FORD, 224 Front Street, New York City, report having secured some very nice orders recently for lubricating oils from some of the largest electric railway companies in the country.

THE DAYTON GLOBE IRON WORKS COMPANY, Dayton, O., has issued a pamphlet on the new American turbine. It gives the results of several tests of turbines of different sizes. These tests are set forth in detail in tubular form

THE DIAMOND MACHINE COMPANY, Providence, R. I., is shipping to the Japanese Government a large consignment of grinding machinery. The shipment will comprise a large number of articles, including large water tool grinders.

"THESE SPEAK FOR US."—The Lafayette Engineering & Electric Works, Lafayette, Ind., have issued a pamphlet under the above title. It describes briefly the various designs of dynamos built by the company and gives several testimonials from users of the company's machines.

THE W. S HILL ELECTRIC COMPANY, of New Bedford, Mass., has made a change, having organized a new company under the laws of Massachusetts, with a $70,000 capital. With its new and commodious factory it will be in a better position than ever before to handle its business.

THE HAWLEY DOWN DRAFT FURNACE is said to be in operation in over 3000 electric plants throughout the country. The Hawley Down Draft Furnace enables them to crowd the boilers far beyond their rated capacity on short notice. This company, whose headquarters are in Chicago, furnishes a handsome catalogue upon application, containing very valuable hints on the care of boilers.

MR. JAMES D. BIDDLE, Drexel Building, Philadelphia, is making a specialty of voltmeters, ammeters and wattmeters of the Weston standard type and is agent for Willyoung & Co.'s electrical testing sets and scientific apparatus. This latter firm is making a specialty of a Rowland D'Arsonval galvanometer, patented by Prof. Rowland. This galvanometer is adapted to cable testing and work requiring a sensitive and quick-acting instrument.

THE ERIE RAILWAY COMPANY, after careful investigation and the consideration of a number of plans, have contracted with the Dodge Coal Storage Company, of Philadelphia, Pa., for a 150,000-ton storage plant at East Buffalo, N. Y. The coal will be stocked in nine divisions or piles, each of about 17,000 tons capacity. The plant will be constructed under the patents of the well-known Dodge system, with the latest improvements, including a complete haulage system for handling the cars. The efficiency of the Dodge system is demonstrated by the fact that every railway using it has contracted for a second plant after more or less extended experience with the first.

THE BOSTON & MONTANA CONSOLIDATED COPPER & SILVER MINING COMPANY, of Great Falls, Mont., is erecting a new electrical power house in connection with its large mining plant. This building is to be modern in all respects. The Berlin Iron Bridge Company, East Berlin, Conn., has the contract for furnishing the steel work. The building will be absolutely fire-proof and the covering will be lined with the Berlin Company's patent anti-condensation roofing lining. This material has proved itself to be very efficient for lining on engine and dynamo room roofs, and the Bridge Company is constantly receiving orders for this work from all parts of the country.

Business Notices.

BATTERY CUT-OUT CHEAP.—Sensitive, reliable, never requires attention. Gas lighting much improved by its use. Electric Supply Company, of 15 South Warren Street, Syracuse, N. Y.

"REFRIGERATING MACHINERY," containing the general principles of refrigerating and ice-making machinery, by George Richmond, M. E., mailed free on receipt of 20 cents in stamps. American Engineering Publishing Company, 333 Adams Street, Brooklyn, N. Y.

Illustrated Record of Electrical Patents.

UNITED STATES PATENTS ISSUED MAY 5, 1896.

[In charge of Wm. A. Rosenbaum, 177 Times Building, New York.]

559,349. RHEOSTAT; W. S. Andrews, Schenectady, N. Y. App. filed Dec. 12, 1895. A resistance card for rheostats, consisting of a tube of insulating material wound with a metallic conductor and flattened and folded upon itself lengthwise, the ends of the conductor being located at one end of the resistance card

559,352. INDICATOR FOR BOWLING ALLEYS; F. Becker, North Plainfield, N. J. App. filed April 24, 1895. The combination with the electric circuits and connections and the electromagnets in such circuits, of indicator pins, cranked shafts supporting such indicator pins, and armature levers connected to the cranks for raising the indicator pins by the magnets when the circuits are closed, and springs for swinging the indicator pins down horizontally when the circuits are broken.

559,356. ELECTRIC RAILWAY; H. Brandenburg, Chicago, Ill. App. filed March 11, 1895. A rail bond for electric railways, formed integral in cross-section, having the tread surface for the wheel, and a longitudinal chamber or cavity formed in the body thereof, with a relatively narrow longitudinal slot or opening leading to said chamber. (See Illustration.)

559,357. ELECTRIC RAILWAY; H. Brandenburg, Chicago, Ill. App. filed May 2, 1895. In an electric railway, the combination with a channel-iron base having the upwardly extending webs forming horizontal seats, and the slot rails of the conductors seated on the upwardly-extending webs of the channel iron, with retainers for holding said conductors in place.

559,366. SWITCHBOARD FOR TELEPHONE EXCHANGES; J. P. Davis, New York, N. Y. App. filed Aug. 10, 1895. In combination, an annunciator switchboard containing a connection-socket and an annunciator for each telephone line of the exchange, a multiple switchboard of several sections, each having in it a terminal connection-socket of each line of the exchange, and trunk lines extending from the said annunciator-board to each section of the said multiple board.

559,367. SWITCHING APPARATUS FOR TELEPHONE EXCHANGES; J. P. Davis, New York, N. Y. App. filed Aug. 10, 1895. In combination, several telephone lines terminating in connection sockets on different switchboards, an indicator adapted to indicate any of the several objects for one of the lines in an annunciator board, and means for controlling the indicator from the sub-station, and trunk lines from the annunciator-board to each of the switchboards.

559,376. COMPOSITION FOR ELECTRIC INSULATION AND PROCESS OF MAKING SAME; A. Gentzsch, Vienna, Austria-Hungary. App. filed April 5, 1893. A composition of matter for electric insulation consisting of shellac and rosin, of birch-tar oil and anilin-oil and of arthracene.

559,380. ELECTRIC MOTOR AND MOTOR-GENERATOR; L. Guttman, Chicago, Ill. App. filed July 10, 1894. The combination in the armature of an alternating-current machine, of the main winding, the sub-circuits of variable resistance associated therewith, and means for regulating the resistance of said sub-circuits.

559,387. ELECTRIC ARC LAMP; A. Jordan, Vienna, Austria-Hungary. App. filed Feb. 12, 1896. In an electric arc lamp in combination with a carbon and mechanism for feeding the same, of two rolls rotating in fixed bearings and both adapted to rest at their peripheries upon the conical end of the carbon and to permit of the feeding of the same only by the consumption of the end thereof.

559,397. ELECTRIC SIGNALING APPARATUS; T. G. Morse, Erie, Pa. App. filed Oct. 8, 1895. In an electric signaling apparatus, the combination of an electrical supply, an electric circuit; mechanism operating upon said circuit to effect a signal, a closed box containing said mechanism, a locking means for normally locking said signal-operating mechanism against movement, a "pull" mechanism extending without said box, means actuated by said pull mechanism for releasing the signal operating mechanism and a catch that locks said pull mechanism against actuating a second operation.

559,403. ELECTRIC LIGHT ATTACHMENT FOR GAS FIXTURES; P W. Remig, Brooklyn, N. Y. App. filed Jan. 25, 1895. The combination with the gas conveyor and two lengths of tubing concealing the gas conveyor and an interior diameter greater than circumferential measurement of the latter, of a socket formed as an integral structure and an approximately cylindrical shape having screw-threaded outlets and a longitudinal opening of two diameters, a set screw for adjustably fixing the socket on the gas conveyor and nipples applied to the screw-threaded outlets of the socket.

509,407. ELECTRIC ARC LAMP; C. E. Scribner, Chicago, Ill. App. filed Dec. 30, 1893. The combination with an electric arc lamp, of a cut-out circuit about the lamp, a normally energized electromagnet, an armature for said electromagnet controlling the continuity of the cut-out circuit, said armature being normally so far distant from the electromagnet as to be unattracted thereto, and mechanism actuated by the feeding lever of the lamp to bring the said armature into range of its electromagnet under the influence of an abnormal resistance in the main circuit.

559,408. ELECTRIC ARC LAMP; C. E. Scribner, Chicago, Il.; App. filed Jan. 9, 1894. The combination with the carbon-rod of an electric-arc lamp, of a collar thereon, a contact point in the path of the collar to raise the same, and mechanism connecting the contact point with the feeding mechanism of the lamp adapted to move the contact point in the same direction as the carbon-rod, the carbon-rod being connected with one terminal of the lamp and said contact point with the other terminal thereof.

559,409. TELEPHONE CIRCUIT FOR POLICE BOXES; C. E. Scribner, Chicago, Ill. App. filed Jan. 26, 1894. The combination with a police box containing a brake wheel and its contact points, and the electromagnet, of a signal bell included in a signaling circuit connected with a central station, of a shunt circuit about the police box including two condensers, and a telephone connected from a point of said shunt-circuit between the two condensers, the other terminal of the telephone being connected to a return-conductor to the central station.

559,410. APPARATUS AND CIRCUIT FOR TELEPHONES; C. E. Scribner, Chicago, Ill., and F. R. McBerty, Downer's Grove, Ill. App. filed Jan. 8, 1895. The combination with a source of variable current, of a closed circuit therefor, including a translating device, a conductor having considerable self-induction, and included between one pole of the source of current and the translating device, and a shunt including a resistance coil connected from the other pole of said source of current to the centre of the conductor having self-induction, whereby the fluctuations in the current through the translating device is prevented.

559,411. APPARATUS FOR TELEPHONE SWITCHBOARDS; C. E. Scribner, Chicago, Ill., and F. R. McBerty, Downer's Grove, Ill. App filed Feb. 28, 1895. The combination with a connecting-plug in a telephone-switchboard, of a supervisory signal associated therewith in a circuit normally open at two points, registering contacts in the plug and springjack adapted to close the said circuit at one point, and a relay controlling the break at the other point, the relay being connected with the circuits of the plug to respond to current therein.

559,412 ELECTRIC ARC LAMP; R. Segerdahl, Chicago, Ill. App. filed Sept. 10, 1895. In an arc lamp, the combination with a flexible carbon-rod, of a clutch through which said carbon-rod is passed, and by means of which the same is fed forward, and a guide or support around which the flexible carbon-rod is adapted to be bent.

559,416. ELECTRIC PUSH BUTTON; G. J. Soper, Brooklyn, N. Y. App. filed May 17, 1895. An electric push button consisting of a screw-threaded portion or neck adapted to be secured to the wall of a building, and carrying the usual movable and fixed contacts, a screw-threaded cap adapted to be screwed onto said screw-threaded portion, and provided with an opening; a push button proper guided by its shank in said opening, and a removable finishing plate provided with a central opening to receive the screw-threaded portion and adapted to be pressed by the cap against the wall.

559,419. INDUCTOR-MOTOR; C. P. Steinmetz, Schenectady, N. Y. App. filed Feb. 15, 1896. An inductor dynamo having inwardly projecting pole-pieces provided with field magnet windings, armature coils mounted upon the polar faces, and a revolving inductor. (See Illustration.)

559,461. TROLLEY WHEEL; J. McKenna, Johnstown, Pa. App. filed March 2, 1896. In a trolley wheel a separable inner wearing-flange on each side of a central hub, and an outer supporting flange fitting against the inner flange, and adapted to support the outer edge of the same.

559,474. LAMP SOCKET; H. C. Wirt, Schenectady, N. Y. App. filed Feb. 8, 1896. As a new article of manufacture, a supporting frame for the key shaft of an incandescent-lamp socket, having the socket of one of its bearings adapted to be opened or closed, receive the key shaft laterally, and secure the latter in place.

559,476. TELEPHONE TRANSMITTER; L. D. Appleman, Waynesborough, Va. App. filed May 25, 1895. In a telephone transmitter, the combination with a diaphragm, a bridge secured to the back of said diaphragm, and an electrode carried by the said bridge; of a carriage supported above the said bridge, conducting pencils loosely hung in the said carriage and hanging between the diaphragm and the electrode, resting upon the latter.

559,479. TELEGRAPHIC RELAY; C. G. Burke, Brooklyn, N Y. App. filed Nov. 21, 1895. A rotary coil for relay instruments adapted to be suspended or supported in a magnetic field and consisting of a spool or core with a conductor wound thereon in convolutions parallel with its axis, the direction of the winding being in opposite halves of the coil and no two immediately successive convolutions or paths in the same direction being contiguous to each other.

559,518. AUTOMATIC TIME RECORDING INSTRUMENT; H. F. Eaton, Quincy, Mass. App. filed March 20, 1893. In an automatic time-recording instrument, the combination with printing and impression receiving members, and means to automatically and regularly move the same, one with relation to the other, of an arresting device to prevent at times the marking of an impression by said relatively and regularly moving printing and impression-receiving members.

559,529. ELECTRICAL SAFETY LOCK FOR ELEVATORS; A. C. Hunt, Denver, Col. App. filed Jan. 17, 1896. The combination of the elevator shaft door, the elevator car, the motor-controlling mechanism, the electromagnet fixed on said motor-controlling mechanism, the armature for said electromagnet, a locking bolt connected with said armature, guide pins for said locking bolt, guides for said bolt, a stationary recessed segment, and an electric circuit in which is included said electromagnet, and which is made and broken by the opening and closing respectively of the elevator shaft door.

559,530. SYSTEM OF ELECTRICAL DISTRIBUTION; J. F. Kelly, Pittsfield, Mass. App filed Nov. 20, 1895. In a system for alternating currents of different phase, having an otherwise normally-unbalanced mutual

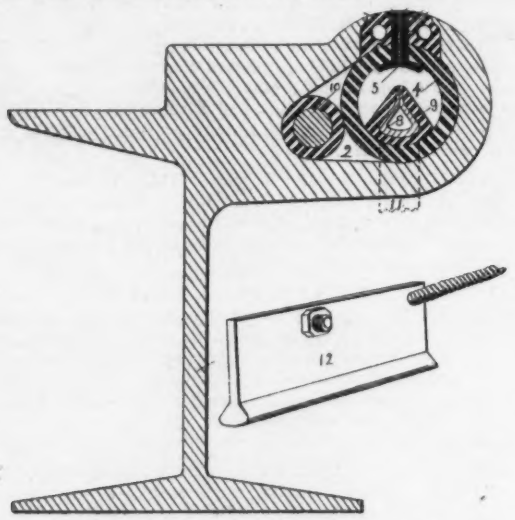
induction, a balancing transformer having its coils in series respectively with the mains carrying the currents of different phase.

559,531. DYNAMO-ELECTRIC MACHINE; J. F. Kelly, Pittsfield, Mass. App. filed Jan. 18, 1896. In a dynamo-electric machine, an armature consisting of two stationary laminated rings, in combination with connecting bolts or bars embedded in said laminated rings and forming a magnetic bridge between them.

559,533. ELECTRIC BELT; G. N. Moore and R. C. MacCulloch, New York, N. Y. App. filed April 17, 1895. The combination in an electric belt, of the belt web folded along the middle lengthwise, and battery cells having a perforated attaching-flange secured to one of the folded parts, and said parts being laced along the open edge.

559,538. PILLOW BLOCK FOR DYNAMO-ELECTRIC MACHINES AND MEANS FOR SUPPORTING SAME. P. W. Power, Pittsfield, Mass. App. filed Feb. 19, 1896. In a dynamo-electric machine having a stationary armature, two bars extending through the machine, so as to have the ends protruding from each end of the machine, in combination with a pillow block supported from said protruding ends, the parts being secured against longitudinal movement.

559,553. ELECTRIC HEATER; W. F. Warner, Muncie, Ind App. filed Aug. 2, 1895. In an electric heater, the combination with the casing and a conductor-coil, of a series of blocks forming a non-conducting surface detachably secured to the back of the casing, and formed with a notch at each end, a projection extending from the notches, and of a length less than the length of the notches, and provided with inclined ends forming an inclined opening between the ends of the projections of the adjacent sections through which the coil is adapted to be passed.



No. 559,356.—Electric Railway.

559,576. ELECTRIC RAILWAY SIGNAL SYSTEM; L. J. Everest, Omaha, Neb. App. filed July 12, 1895. In an electric alarm-signal, the combination of a spring-actuated train of gearing, an actuating lever, said lever being in connection with said train of gearing, said gearing being normally in an unwound condition, said lever being so arranged as to wind said train of gearing when actuated by a car-wheel, said train of gearing terminating in a gear fixed to a vertical shaft, said shaft being provided with an arm, swinging rectangular levers secured to said arm, a contact-point normally suspended by the said arms, said contact-point comprising a spool mounted upon said vertical shaft, a second contact-point below said suspended contact-point, said contact-points forming electrical terminals, in connection with a suitable electric circuit, said instrumentalities being so arranged that as the train of gearing is actuated, the suspended electric terminal is permitted to drop and complete the circuit.

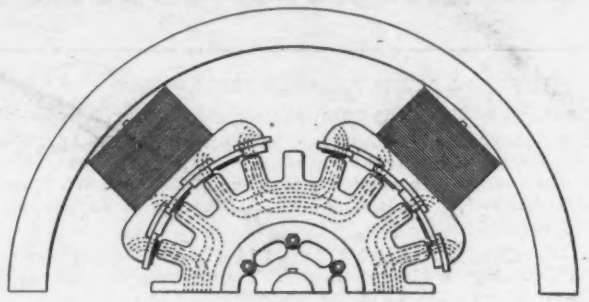
559,584. DYNAMO-ELECTRIC MACHINE; J. F. Kelly, C. C. Chesney and P. W. Power, Pittsfield, Mass. App. filed Jan. 22, 1896. In a dynamo-electric machine the combination of a revolving inductor with a stationary armature, an energizing-coil, and stationary copper bobbin surrounding the revolving inductor, the bobbin carrying the energizing-coil.

559,585. ELECTRIC CURRENT REGULATOR; A. S. Krotz, Springfield, O. App. filed Jan. 22, 1894. In a regulator, a sectional solenoid, the sections of which are joined together by exposed metallic connections, a movable device connected to the core of said solenoid so as to contact successively with the exposed parts of the respective solenoid-sections, said movable contacting device having a high resistance, being adapted to simultaneously connect with two or more of said sections.

559,586. ELECTRICAL CONTACT DEVICE FOR SUBWAYS OR CONDUITS; A. S. Krotz, Springfield, O., and W. P. Allen, Chicago, Ill. App. filed Nov. 14, 1895. A contacting device consisting essentially of spring-standards having contacting shoes, a supporting post formed of steel plates secured together through the medium of spacing blocks, and insulating material included between said plates and spacing blocks, and a frame for supporting said head or post.

559,616. SYSTEM OF CURRENT SUPPLY FOR TELEPHONES; C. E. Scribner, Chicago, Ill. App. filed Jan. 8, 1895. The combination with a telephone circuit, of a microphone and a telephone in the circuit, a condenser included in the circuit between the microphone and the telephone, and a source of electric current for supplying the microphone connected through a resistance coil with that portion of the line including the microphone.

559,648. ELECTRIC ARC LAMP; M. Wheless, Washington, D. C. App. filed Dec. 7, 1895. The combination of the feed yoke, the cap or dome, the counterweight-track jointed to both the dome and the yoke and the counterweight carried by and freely movable on said track.



No. 559,419.—Inductor Motor.

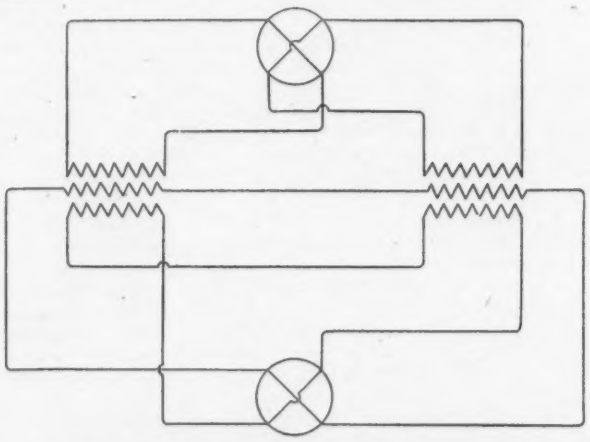
559,649. ELECTRIC ARC LAMP; M. Wheless, Washington, D C. App. filed Jan. 29, 1896. The feed magnet or magnets included in the arc circuit of the lamp, and the feed mechanism controlled thereby, in combination with the regulator magnet included in a high-resistance shunt from that circuit, and a shunt circuit around the arc, and the feed regulator magnets completed through either one or two sets of contacts controlled by the regulator magnet, according as the potential of the arc circuit materially exceeds or falls below normal.

559,685 RHEOSTAT; H. P. Davis, Pittsburg, Mass. App. filed July 10, 1895. A rheostat comprising a plurality of sets of resistance coils arranged concentrically, two sets of metal plates respectively connected to the opposite ends of said coils, whereby said coils are joined in series and a set of contacts directly attached to and supporting one set of said plates.

559,688. BLOCK SIGNALING ON RAILWAYS; J. G. Dixon, Huddersfield, England. App. filed Nov. 25, 1895. In a block system, the combination with a signal and a contact maker connected to the rails adjacent thereto, of a second signal, and a second contact maker connected to the rails adjacent thereto, electromagnets, battery and wires operatively connected together and to the first circuit-maker, electromagnets, a battery and wires operatively connected together to the second circuit-maker, and a revoluable contact-maker formed of two parts, similar driving mechanisms connecting the said parts with electromagnets, and a battery and wires connected to the said revoluble contact-maker, and with the first signal, said devices operating to cause a current of electricity to pass through the wire when the electromagnets have been energized successively for the same number of times by the passage of the wheels of a train over the said circuit-makers pertaining to the said electromagnets.

559,692. ARMATURE FOR ELECTRIC MOTORS AND DYNAMOS; J. P. B. Fiske, Alliance, O., and H. A. Littlefield, Lynn, Mass. App. filed Dec. 14, 1894. The combination with an armature core or drum, having annular extensions at its ends, of a series of coils disposed on said core or drum, and having their ends disposed on said annular extensions.

559,701. CONDUIT FOR ELECTRIC LINES. J. Graizier, Geneva, Switzerland. App. filed Nov. 4, 1895. An insulating conduit consisting of a trough of concrete and a cover therefor, a bottom layer of pieces of broken refractory insulating substances and bituminous material filling the interstices, and cross-bearers of terra-cotta or similar material having recessed upp r edges and laid therein at intervals, longitudinal groups of conductors laid upon said layer of insulating material and within the recesses of said cross-bearers, and a second layer of such insulating material above the conductors.



No. 559,721.—System of Electrical Distribution.

559,721. SYSTEM OF ELECTRICAL DISTRIBUTION; B. G. Lamme, Pittsburg, Pa. App. filed April 11, 1895. A means for changing the phase and wave form of alternating-electric currents, comprising two transformers each of which is provided with two secondaries, those of one being respectively connected directly, and reversely in series with those of the other.

559,752. ELECTRIC ARC-LAMP CARBON; J Roubal, Prague, Austria-Hungary. App. filed Dec. 27, 1895. An electric arc-light carbon, the surface of which is incrusted with a mixture of pure carbon and a silicate (preferred water glass) or boric acid.